..Return to..
PRESIDENT'S OFFICE,
15 DEY STREET, N. Y.

TELEPHONE ENGINEER

Vol. III CHICAGO, APRIL, 1910 No. 4

D. & T. ANCHORS

DRIVE with a Sledge
TWIST with a Bar

Note the Shape of the Eye. Flat on top,—to take blow of the sledge

Showing wings folded as Anchor being driven.

Drive & Twist

THE D. & T. ANCHOR can be installed in the least time, with the fewest tools, for the least cost to hold the load, with no interruption of traffic, and less complaint from property owners, than any other anchorage, patent or dead man. Can be driven on private property, where digging would not be tolerated.

Freight prepaid on opening order of twelve or more.

Nickel plated miniature D. & T. Anchor mailed free.

"Only One Man Needed"

No Screwing
No Digging
No Tamping
No Pulling

No Special Tools Required

Can be driven at any required angle—up to the full length of the rod

Note that the Blades Rest on the Rod—they depend upon the Rod, not on the Pin, for support.

Note the cone-shaped head—Protects the blades in any soil.

ASK YOUR JOBBER
or

The Vote-Berger Co.

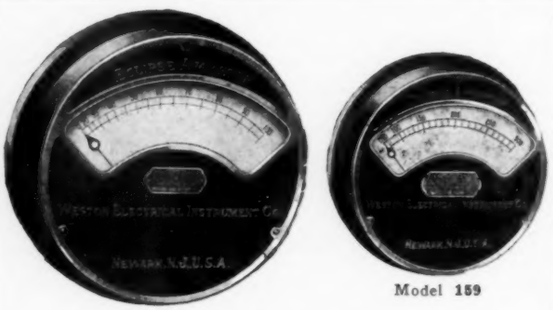
LA CROSSE, WIS.

WESTON HIGH GRADE Direct Current

Switchboard Ammeters and Voltmeters

Model 24 Model 57

WESTON Standard Models, permanent magnet moving coil instruments for important service.



Model 160 Model 159

ECLIPSE Models, "Soft Iron" or "Electro Magnetic" type for general use in small plants where low cost is desired and great accuracy is not required.

Send for Catalog and complete information to

WESTON ELECTRICAL INSTRUMENT COMPANY

NEW YORK OFFICE, 114 Liberty St.
LONDON, Audrey House Ely Place, Holborn

Waverly Park, NEWARK, N. J.
BERLIN, Ritterstrasse 88

IF YOU DO NOT TIME YOUR TOLL MESSAGES

You are CERTAINLY losing part of your earned REVENUE

¶ **THE CALCULAGRAPH** tells exactly how much use of a toll line is chargeable to the public, including "excess" or "overtime." It subtracts the time-of-day a toll conversation is commenced from the time-of-day it is finished and prints the difference—the elapsed time of the actual use of the circuit in minutes and quarter minutes.

¶ **THE CALCULAGRAPH** records enable you to collect all the toll revenue you earn.

Ask for our booklet

CALCULAGRAPH COMPANY

1456 Jewelers Building NEW YORK CITY

Matthews' Matthews' Matthews'

MATTHEWS' CABLE ROLLER

Callahan
Patent Number 856335

DETAIL OF MATTHEWS' CABLE ROLLER

Altho Matthews' Cable Rollers will pay back their cost in the amount of time they will save over any method of pulling up aerial cable without rollers, yet this is not as important as the fact that their design makes it practically impossible for a construction crew to injure the lead covering during installation.

More cable trouble can be traced back to injuries received during installation than to all other causes combined, unless the greatest of care is exercised.

Send for copy of article by Chas. Milan on "The Use of Cable Rollers." It's free.

W. N. MATTHEWS & BROTHER

229 N. SECOND ST., - - ST. LOUIS

Matthews' Matthews' Matthews'

TELEPHONE ENGINEER

VOL. III — CHICAGO, APRIL, 1910 — NO. 4

PUBLISHED MONTHLY BY THE

ELECTRICITY MAGAZINE CORPORATION

MONADNOCK BUILDING, CHICAGO.

ED J. MOCK and PAUL H. WOODRUFF, Editors.

LONG DISTANCE TELEPHONE: HARRISON 3014.

EUROPEAN OFFICE.....36 Maiden Lane, Covent Garden, London
S. RENTELL & Co., Representatives.

Entered as second-class matter May 26, 1909, at the postoffice at Chicago, Illinois, under Act of March 3, 1879.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico.....Per year, $2.00
Canada.....Per year, 2.50
Foreign countries within the Postal Union.....Per year, 3.00
Single Copy..... .20

DISTRIBUTING AGENTS: The Western News Company and its International Branches.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach the office of publication not less than ten days in advance of date of issue. Regular date of issue, the first day of each month. New advertisements will be accepted up to within five days of date of issue, but proof of such advertisements can not be shown until the appearance of the edition containing it.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft or money order, in favor of TELEPHONE ENGINEER. Foreign subscriptions may be remitted direct by International Postal Money Order, or sent to our London office.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

DATE ON WRAPPER indicates the month at the end of which subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publisher.

CLUB RATE.—In acknowledgment of assistance rendered by subscribers in the securing of new orders, a club rate of $1.50 per annum is quoted. This rate applies to new subscriptions in clubs of two or more.

Copyrighted, 1910, by ELECTRICITY MAGAZINE CORPORATION.

CHICAGO, APRIL, 1910.

TABLE OF CONTENTS

Editorial 149-152
Telephone Equipment of the New Theater. By D. H. Braymer..153-155
Ohio Independent Convention.....156-157
How to Read Telephone Circuit Diagrams. By D. S. Hulfish.....157-160
Telephonic Intelligibility. By George A. Campbell.....161-163
Items of Legal Interest. By Ralph M. Loring.....164-165
What One Woman Thinks. By Sarah Elizabeth Brown.....165-166
Experiment in Sound Reproduction. By Emil Kosack.....167-168
Chicago Independent Gets Start..... 168
Who's Who in the Telephone Game.....169-170
A. T. & T. Company's Report.....171-172
Some Romances of the Telephone. By J. Rodney Bates.....173-174
Dry Cells and Their Characteristics. By Prof. Charles F. Burgess and Carl Hambuechen.....175-176
Recent Telephone Patents. By David S. Hulfish.....177-178
Department of Railway Telephones.....179-186
Of Interest to the Trade.....187-192
Telephone Boosters at Pittsburg..... 187
Duplex Metals Company.....188-189
Western Electric Reports.....189-190
Kellogg Items 191
Stromberg-Carlson Literature 191
Gets Automobile Idea from Telephone..... 192
Brevities of the Business.....193-196

A. T. & T.'s REPORT.

THE hammers are always busy in the telephone business. That sounds good. Great industry, pleasant hours of labor, smoke always going up the chimney, and all that. Don't quite like the word hammer, though; suggests—well, you know—something not so pleasant.

Yes, and that's what we mean. Partly, at least. The wheels of industry are whirling, all right; but some men who ought to know better are doing their best to stop them with tack hammers. They knock along dolefully through the year, and then along about prediction-season they get together for a crescendo chorus. Then—bang!—the A. T. & T. annual report comes out. Not that its appearance stops the knocking; oh, dear, no—rather increases it, if anything. But it does make it sound discordant, and foolish, and puerile. Because any one reading that report, all alone and apart from Standard Oil and Steel reports, would swear that the telephone business is the biggest business in the world. Gross revenue collected from the public for telephone service in 1909 by the Bell system—not including connected independent companies—$150,000,000. Nice business for a year.

The estimated increase of population of the United States last year was about 1,600,000. The increased number of Bell telephones in the same period was 778,063. Query: Granting an equivalent increase for the independents, and figuring on the basis of 8,000,000 present telephones in use (the Bell claims 5,142,692), in what year will saturation be reached?

President Vail recommends in the report that the capital stock of the American Telephone and Telegraph Company be increased from $300,000,000 to $500,000,000. It is the purpose to finance each of the associated companies locally so far as possible in the future. Probably this is a lesson learned from the independents. It is hard enough for any public service corporation to get humanly near the dear people; naturally the company in which Bill and Jim and Pete have put their money has the advantage as compared with the one wholly financed from Billionaire Row, New York.

There is a paragraph in the report headed, "Rearrangement of Territory," that outlines the purpose of the parent company to continue the bringing together of the associated companies and the more equitable arrangement of geographical boundaries for their operation. This has again started the old rumor that the Chicago Telephone Company is about to be absorbed by the Central Union; and, while this action is not imminent, it will undoubtedly be effected within the next few years.

An interesting bit of telephone history is also included in the report. The statement is made that

in spite of accounts of fabulous prices paid for shares in the original National Bell Telephone Company, the $100 shares never reached a higher quotation than $1,000, and few if any transactions took place at this price, $600 being the highest price at which any considerable amount changed hands.

"Although there have been abuses in corporate management and in the manipulation of both property and securities, *for which there is ample remedy if existing laws are enforced,* yet it must be admitted that the tremendous development of utilities in this country as compared with other countries, with their contribution to the comfort and convenience of the public, is to a certain extent due to the lack of prospective restrictions. * * * It is but natural that corporations should have some misgivings about a control of internal management by a body *without any responsibility that could be called accountability,* and without the practical knowledge or experience or information which comes from the daily dealings with questions; a control which would undertake to decide upon questions widely different, complex and far-reaching, over which expert managers of life-long study and experience are sometimes at a loss; a control over methods of business which usually are the evolution of years of practice, and are so interwoven with the fundamentals of business that they cannot be changed suddenly without great disturbance."

The italics are not ours—they appear just that way in the report. This is apparently a gentle crack at the impending New York legislation which promises to put telephone and telegraph companies under the jurisdiction of the state railroad commission. Evidently the directors of A. T. & T. don't like the prospect. Too bad; for it's surely coming, not only in New York, but in every state that has such a commission. It must be admitted that the larger operating companies will gain little directly from this kind of regulation; but it is a good thing for the little fellows, the local independents who want to raise their rates or cut out their free service or something else, and can't.

Considerable is said about the new relation between the American Telephone and Telegraph Company and the Western Union Telegraph Company. It is promised that many new classes of service, as well as many economies, will be born of the relation, of which the "night letter" and the telegraph message delivered by telephone are the first, and already in effect. The intimate co-operation of the two systems of intelligence transmission undoubtedly will also develop some interesting technical and engineering features, to the advancement of the art in general.

It would not be a Bell report if it did not decry the principle of telephone competition. Some figures are introduced, purporting to show an advantage for monopoly, which deserves an answer from the independent association. In this connection the following statement is interesting:

"While the settlement with the Western Union Telegraph Company in 1879 removed from the field the most formidable and powerful competitor, it must not be concluded that the American Bell Telephone Company had the field to itself. The Bell system did not then, nor did it in any year or any time since the great value of the telephone to the world was established, have a monopoly of the business or anything approaching it.

"Patents and inventions were necessary for defense, but were no protection against imitators.

"There was a continued running fight in the courts and in the field. The fact that the Bell won every case in the courts availed it nothing except that it was credited with a monopoly which did not exist.

The only time that the Bell telephone was without a competitor was at the Centennial Exposition of 1876."

IN THE EYES OF THE PEOPLE

THAT famous old Vanderbilt epigram invoking the wrath to come upon that inconsiderable and impotent portion of the race commonly known as the public was but a fair criterion of the corporate autocracy of its day. But times have changed; the impotent has become potent; the worm has turned. Today, in the insistent demands of the people for clean business and a word in the conduct of those corporations to whose use they lend their name in the term "public service," they have practically placed upon such corporations the burden of proof that their hands are clean.

But, after all, it is very much to be doubted if the old, fundamental attitude toward the public corporation has changed a particle. And that attitude is undeniably antagonistic—whether it be a heritage from the day of the Vanderbilt anathema or merely the result of a corporate policy of secrecy and impersonality.

The telephone is a necessity to the public. That fact in itself is a potent source of dissatisfaction; for it leaves the subscriber no choice but to take it, and at the company's terms. It matters not how fair and reasonable those terms may be; he feels that he is within the power of the company, and the natural instinct that places him on the defensive suggests ample reason for such an attitude. He knows that the company has money and can control legal talent and all the other forms of power that money stands for. He knows that the company was organized solely for the purpose of making money, and that he is desirable as a subscriber simply that the company may make a little more money. He does not grasp the idea that the company may be making little if any more profit on its investment than he would get as interest on his savings in the bank. The inner workings of the corporation are a mystery; and the only function he can conceive for this mystery is the concealment of abnormal profits.

We believe that telephone competition is a splendid thing, and the only solution of many difficulties. But there are a great many communities where there is no such competition, whether the particular local monopoly be Bell or independent. And the people do not like monopolies. They want to be able to exercise a choice—to be able to hold a club over the head of the company in the shape of a threat to change to its competitor. Denied this privilege, they are at once thrown into a suspicious and hypercritical state of mind.

There is no royal road to public confidence. But there is a by-path which, perhaps, will lead more quickly to the desired good than the ordinary practices of the public service company will ever take it. For want of a better name we will call it "openness." If all the transactions of the company are open and public, and the patron is encouraged to learn more about its system and methods, and the representatives of the company strive to remove that impersonal and "soulless" impression with which a corporation is burdened, it is possible to gain even the friendship of "the public." Upon the representative of the company with whom the people come into personal contact rests this burden. To these representatives Edward K. Hall, of the New England Telephone and Telegraph Company, says:

"Always put yourself in the other fellow's place,

and when in doubt apply the Golden Rule. That is fairly simple. Put yourself right in his place, look at it from his viewpoint, and then treat him fairly from his point of view, if possible, and never let a man get away from you without leaving in his mind a feeling of respect toward you and the company. The officers of the company, or the officers of any public service corporation, are never going to solve completely this public-relations problem. They cannot do it. It has been said that the position of the telephone company in dealing with the public is especially embarrassing, because we are so intimate with them. We touch elbows with them here, there and everywhere, in a personal way—in their houses, in their business offices, day and night, all the time—and are consequently more likely to irritate them than are the other companies. The fact that we touch elbows with them so often and come in contact with them at so many points we should turn to our advantage instead of to our disadvantage, because it gives us just as much more opportunity to strengthen and clarify our relations with them. If we only use them right, there is a whole army of us who ought to be making friends for the company. What we need is concerted, thoughtful action. Just as soon as the public begins to say that this company is different from the general run of corporations, that it is just a little better, that it treats people just a little more fairly, that it is just a little more considerate of the public, then our greatest danger has, to my mind, been largely removed. The way to achieve that, as I have said repeatedly, is for every individual connected with the organization to treat the public just as he would treat them if he himself were the whole company and had the whole responsibility, present and future. That attitude, practiced faithfully and patiently by every man, would, I believe, in the long run put us in the class where we would all like to see ourselves in the minds of the public—namely, that of being a public service corporation which is just a little different and a little better than the average."

THE ELSON BILL

IT appears at the present writing that the Elson bill will pass the Ohio senate—unless, perchance, its sponsors become afflicted with cold feet because of the pending investigation of the bill's lobby.

The force of existing Ohio statutes was probably the only influence that prevented the sale of the Ohio independents to A. T. & T. instead of to Morgan. Brailey evidently bungled the deal. He was not a good Indian; for a good Indian leaves no trail, and Brailey's trail led all too plainly to the Bell wigwam. So Morgan, the mighty hunter, stepped in and said: "I will carry the pack; for I am the Big Chief, and none will deny me." And he saved the situation.

Obviously the next logical Bell step, since the legislation on hand or in stock was unfavorable, was to throw it out and get new. The Elson bill is the new stuff—and good material for the purpose, too. Here it is as it passed the house:

Section 1. That whenever two or more competing telephone companies are operating lines which intersect or parallel each other on a public highway, or whenever such companies are engaged in the telephone exchange business in the same municipality, such companies may connect their lines and equipment in such manner that subscribers and patrons of one company may obtain telephonic connection with subscribers and patrons of the other company or companies. When the lines and equipment have been connected the plant shall be owned, operated and maintained in the manner and upon the terms agreed upon between the boards of directors of the respective companies. If it be deemed necessary by said companies in order to provide a more satisfactory connection of lines and equipment, that a consolidation of the properties of said companies be made, then and in such event such consolidation is hereby authorized to be made, it shall be made in the same manner and with the same effect as provided for in sections 9,026, 9,028 and 9,029 of the General Code relating to the consolidation or railroad companies; provided that all consolidations herein authorized shall be made only upon the approval of and by and with the consent of the Railroad Commission of Ohio, and shall be subject to all laws governing the consolidation of railroads. Said Railroad Commission is hereby empowered with the duty of determining and fixing when deemed necessary to the public interest, all charges, tolls and rates for business done within the state of Ohio, and hear and determine all complaints in regard thereto in accordance with the powers vested in it by sections 487 to 614 of the General Code.

It is said that the bill's passage is assured because so many independents are in favor of it, in addition to its Bell support. Undeniably it offers to these insurging independents an opportunity to sell their properties, if they wish, to a very likely customer, or to make such use of their competitor's lines as may be mutually agreeable.

As a Bell measure, even as an insurgent independent measure, the provisions of the Elson bill might work out satisfactorily. But Ohio has always been regarded as an independent stronghold—independent in the old anti-Bell way. Already that reputation is tottering; and if it passes this bill it can never regain its former footing.

The National Independent Telephone Association, still retaining all the strength of the old, simonpure independents, should be able to stop this kind of legislation. It has done as much in other states on several occasions in history.

OHIO A DOUBTFUL STRONGHOLD

IT ALL depends upon the point of view. One man will look upon a stately forest and see nothing but great piles of lumber; another will see a beautiful picture; still another the tremendous fields of waving grain that might be there at the sacrifice of the trees. It is something like that in Ohio. Every telephone man has his point of view and there is no unanimity of opinion.

The rank and file of independent telephone men do not believe that the Morgan properties are to remain strictly independent of Bell interests. They discredit the Morgan statements and the defense of Morgan that has been presented by his agents. The independent operators who have not sold their properties and who, like other humans, would sell if they could get a satisfactory price, frown upon the Morgan transactions, because they show class preference, including nearly every exchange of the better class and the essential and very necessary long distance company with which all the rest are connected.

The recent convention at Columbus was attended by many men who were particularly interested in getting to the bottom of things that had upset their plans. Unfortunately that convention failed to develop anything satisfactory, from the viewpoint of the sturdy operator who had established his business upon the teachings of independent telephony. The only demonstration that independent telephony must survive or fail upon the original basis came from the president of the national association. Mr. Wood's

address before the convention was forceful and earnest, but the applause lacked the feeling that has heretofore been evident in the Buckeye state. Two years ago, in the same room in the same hotel, the important transaction of the convention was to raise money as a defense fund. Companies vied with each other in their subscriptions. It was a great rally for the shield, the intangible, indescribable something that held great interests together in a common cause.

This year there was no such problem. The leaders of the Ohio independent crowd offered no apology for the thing they had done. There was a change in the organization—planned now along the lines adopted by the national convention; but the same leaders are at the head of the independent movement. Present conditions in Ohio are vastly different from what they were a little while ago. Those operators who have profited by recent sales are sure that the future is brighter than ever. Those who must go back to their own properties on the promise that they too are better off, have misgivings. They had relied strongly upon the co-operative organization that had been established by men who were identified with them and in a manner identical with theirs. Now they must rely upon the words of the same men, it is true, but the relation is different to the point that these men are, after all, merely the paid emissaries of the largest banking house in the world.

If Ohio is still the stronghold of independent telephony, it will take years of example to convince the skeptics.

THE SENSITIVENESS OF THE TELEPHONE

IN every industry there are marvels to which the mind of the worker becomes unappreciative through too close association. Probably there is no art so full of wonders as telephony, and perhaps none which its workers regard as so utterly commonplace.

From a mechanical viewpoint all telephonic apparatus is extremely simple. No wonder "familiarity breeds contempt" when we stop to realize that fundamentally the whole talking principle of the telephone is based upon a variable resistance and an electromagnet with its armature. None of the several early investigators who are credited with taking some part in the invention of the speaking telephone realized what a marvelously sensitive instrument would result from his simple combinations.

Take the crude carbon-rod microphone, for example. Every school boy knows that through its agency the foot-fall of a fly is perfectly audible; and yet that foot-fall—so infinitesimal to our unaided senses—must, to record its vibration, not only shake the wooden base upon which it strikes, but must communicate that force so powerfully as to change the relative positions of the carbon rods attached thereto. Yet what microscope could reveal the movement of those surfaces, which affects the metal diaphragm so strongly that the auditory nerve becomes sensible of the impact across an inch or more of air space?

But if the microphone can so change its adjustment on the slightest of provocations, consider the sensitiveness of the receiver which must translate that fluctuated current back to positive motion. Our whole conception of physical science stands amazed before the performance of the tiny bar magnet with its insignificant coil of wire and its little disk of iron. The sensitiveness of the human ear that can detect and interpret the movements of the receiver diaphragm is truly remarkable; but the ear is a complex organ, and it has behind it the mystery of the brain. But the receiver has nothing save its ounce of metal and the immutable laws of nature. And Preece has calculated that an audible sound is produced in a telephone receiver by a current of .000,000,000,000,6 ampere, while Pellat finds that a sound is produced by a difference of potential between the terminals of 1/2,000 of a volt.

GETTING INDEPENDENT SUBSCRIBERS IN

THE work of listing subscribers for Chicago's new independent telephone system has begun, and there is no reason to doubt that it will go merrily on past the promised 20,000 mark. But no good ever came of underestimating a competitor, and we have already remarked that the independent building of Chicago is bound to be a hard task. Naturally the strongest appeal of the independent company will be to those whose use of long distance lines is sufficient to make the exclusively independent territory outside of Chicago valuable to them. There should be a great many subscribers of this class in a city of the commercial importance of Chicago. President Joseph Harris, of the Automatic Electric Company, makes this clear when he says:

"We are not fighting the Bell company. Our business is supplementary to theirs, which is altogether too limited. It does not cover the field it pretends to. Its restrictions are hurting Chicago's chances for increasing trade.

"In Illinois 54.6 per cent of the telephone subscribers use the independent system exclusively, while the others use the Bell. The arrangement is unsatisfactory, as country people use our telephone, while Chicagoans use the others."

Working on the basis suggested by this statement, the prospects for Chicago's independent development are splendid, and the benefits to the surrounding independents, who, in the words of the convention speakers, have been knocking at Chicago's door for many years, will be enormous. Good luck to the Chicago independents!

THE TELEGRAPH IN SOUTH AMERICA.

CONSUL Isaac A. Manning, of La Guaira, advises that the government of Venezuela has arranged for international telegraphic communication between Colombia, Ecuador, Peru and Venezuela. He writes:

"Telegraphic correspondence between the governments of Ecuador, Peru and Venezuela concerning the matter is published in the Caracas daily press. The director of telegraph of Venezuela has been instructed to communicate with the government of Peru with a view of extending the intercontinental service to Bolivia, Chile, and thence to the Argentine Republic.

"It is also stated that the government of Venezuela, in connection with the Compania Anonima de Navegacion Fluvial y Costanera de Venezuela, has decided to establish wireless stations of the De Forest system at Pampatar, Coche and Araya, Margarita Island, and on board the steamer Venezuela of the company. I am informed that the apparatus has been ordered from the United States."

Telephone Equipment of the New Theater

By D. H. Braymer

THE New Theater, which was opened early this season in New York City and has for its purpose the fostering of dramatic art, stands apart from modern play-houses as representing the highest achievement in electrical art as applied to the stage. The lighting equipment is the latest development of the automatic operating type. The revolving stage, electrically operated, makes possible the setting of several scenes at one time. The stage managing and directing is systematized, and everything takes place about the stage exactly as it was planned with a smoothness that is comparable only to the precision of clock-work. Every operation in the production of a play is carefully worked out and executed by a definite plan, so that when the curtain rises everything is as it should be minus the confusion which accompanies staging in most of our playhouses.

In the execution of orders at and about the stage, and in the arrangements for the convenience of patrons, the telephone plays an important part. The photographs shown here illustrate the working of two separate telephone systems—the stage or technical director's system and the carriage call system. Each of these systems is especially adapted for the particular service which it performs and was designed, manufactured and installed by the Western Electric Company.

The stage telephone system is an intercommunicating system, comprising nine regular stations about the stage, 25 floor stations and two master stations, or stations from which all the other stations may be reached by signals and brought into communication. One of these stations (Fig. 5) is known as the stage manager's board; the other (Fig. 1) the technical director's board and the one most used in directing the operations on and about the stage. The nine regular stations comprise six stations located in the flies and stage galleries and the stations at the electrician's booth, prompter's booth and for the orchestra

*Photographs Copyrighted 1910 by The New Theater.

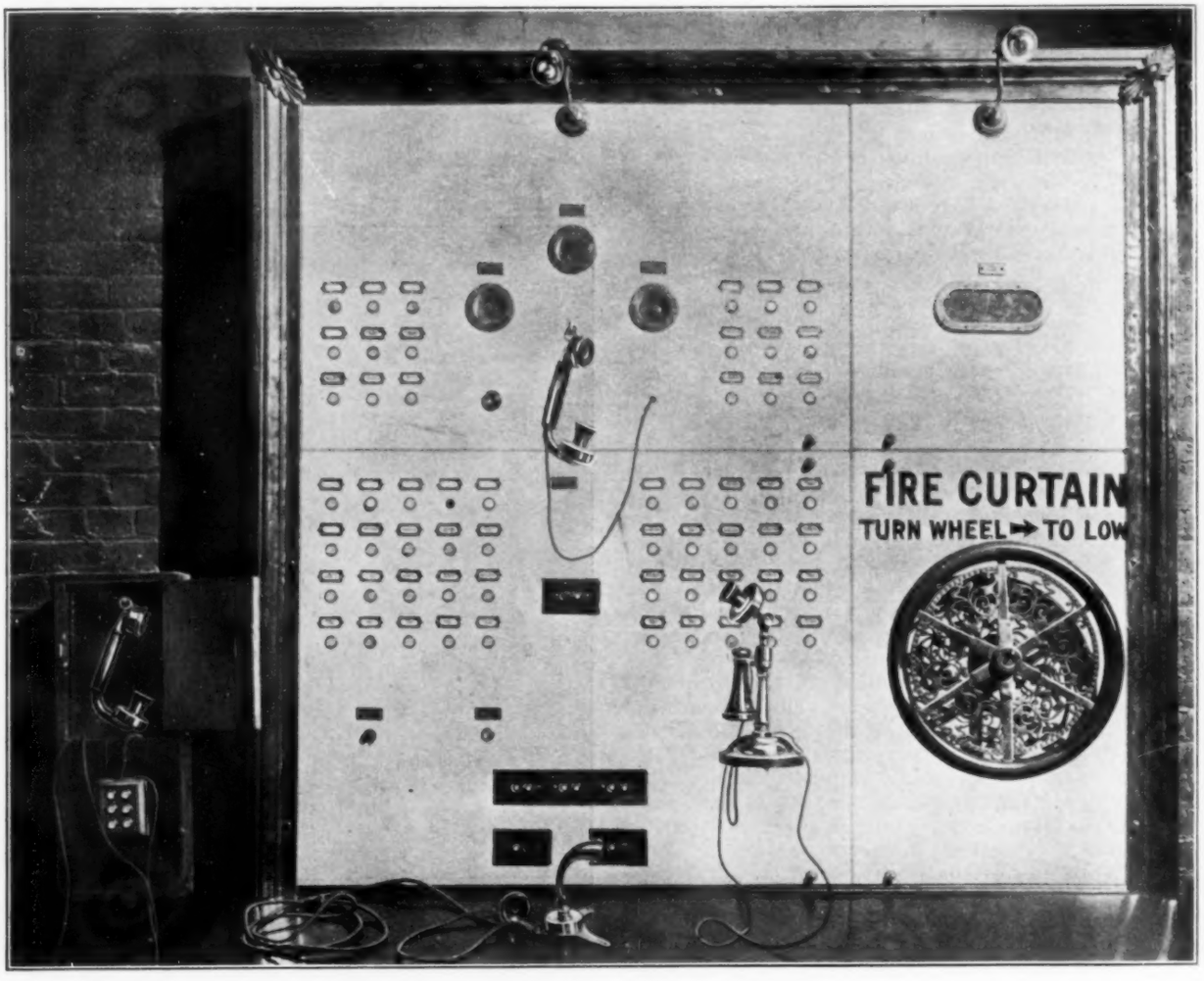


Fig. 1. The Board.

Fig. 3. Telephone Set for Working Gallery.

leader. The six stations located in the flies and galleries are intercommunicating, while the other three are used by the stage manager or technical director to give the cues signals from these respective stations.

The six stations located in the flies and galleries are distributed at important points from the cellar to the eleventh floor. Each is equipped as shown in Fig. 3 with a portable hand telephone set. This station is known as the working gallery, and communication can be obtained between it and the five other stations located as follows: Shot chamber in the cellar, stage floor at controller for revolving stage, working gallery, first fly gallery, second fly gallery and rigging loft at the eleventh floor. These stations are signaled by means of buzzers operated by push buttons shown at the left of the telephone in Fig. 1.

Besides these nine regular stations, there are distributed throughout the stage, flies and galleries twenty-five flush telephone outlets in the floor known as the floor stations, each outlet being suitable for receiving a short telephone plug. Each of these stations is provided with a lamp signal two inches in diameter to indicate the incoming calls. The scene shifters and other stage operators are each provided with a head receiver and chest transmitter attached to a cord which terminates in a plug, which set is shown in Fig. 5. The signals for calling these stage hands are operated by means of push buttons from either the technical director's or stage manager's board. The system is so arranged that when either stage manager or technical director wishes to communicate with any of the stage operators he presses the proper button of those shown at the right and left in Figs. 1 and 5. Those at the right operate the bull's-eye flash signal at the floor stations, while those at the left operate buzzers at the regular wall stations. The arrangement of the bull's-eye lamp signal in the flies and galleries is such that in case it is too noisy about the stage to attract the operator's attention at the regular station by the buzzer located there, the signal can be given him by means of the bull's-eye flash.

In conjunction with the telephone equipment arranged as mentioned a system of call bells is provided to signal stage hands when they are not on the stage. The nine buttons on each side of the technical director's board at the top are used for the purpose and are connected to buzzers located at various rooms where stage help can be found in case of emergency or at other times when they are not on the stage and their services are desired.

The floor stations and flash signal are intended principally for the heads of those departments which have to do with the stage help and scene shifters. The heads of each department with whom it is necessary to communicate wear head receivers and chest transmitters all the time, so that whenever they notice their particular flash signal they know they are wanted and go to the nearest receptacle to learn what is desired. In case the particular head is not near the signal and does not see it, the information is transmitteed to him through the station on the particular fly or side of the stage where he is supposed to be stationed. During the performance of any scene instructions can be given by this method without annoyance or any disturbance whatever. Also any instructions or additional orders can be given for any future changes to be made during the acting of any one scene.

This system is a great convenience to the stage manager and technical director in that it saves many steps and makes it unnecessary to shout from one side of the theater to the other.

Fig. 2. The Telephone Used for Trimming Hangings on the Stage.

Another feature of this telephone system is its use in trimming the ceilings, stage borders and hangers. The technical director does his final trimming for any scene from the first row in the orchestra, as shown in Fig. 2. It will be noticed that the telephone set used in this case is a portable hand set, the same as in Fig. 1, which is an extension to the corresponding telephone set at the technical director's board. The set is connected to this board by means of a flexible cord, which is about 30 feet, or long enough to reach to the first row in the orchestra. By means of a portable set of buttons which the technical director holds in his hands he is able to signal the six important stations in the flies and galleries mentioned above. With communication between these stations he is able to make any changes which he finds necessary by viewing the setting from the body of the house.

The second telephone system mentioned is the one connected with the carriage call system. As shown in Fig. 4, the attendant located at the window of the lobby is equipped with a head receiver and chest transmitter which is attached to a line terminating in a plug receptacle in the sidewalk on the outside of the building near the entrance. At this station another attendant is stationed at the end of the performance provided with a hand telephone set plugged into the receptacle, thus connecting him with the attendant in the lobby. As the patrons of the theater come out of the house into the lobby they step to the window and announce the number of their carriage or automobile. This number is flashed on two electric signs, one at the top of the theater at the front and the other on the side. When the driver recognizes his number and appears in the line so that the attendant on the side-walk can see him, this attendant then transmits the number through his telephone to the attendant at the window, who in turn announces it to the patron. This system works out very satisfactorily, and is one which gives ready information to the patron who is waiting without making it necessary for him to leave the lobby.

Fig. 4. Telephone Sets Used for Carriage Calls.

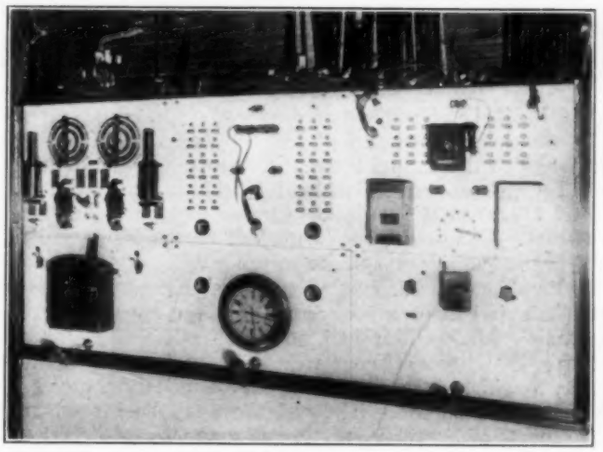


Fig. 5. The Technical Director's Board.

In addition to these private line telephone systems the theater has installed a standard Western Electric private branch exchange switchboard with approximately 36 house extensions to the various places about the stage, box office entrance and executive offices, arranged with six trunk lines connected to the city exchange.

4321 Gets Western Union Anywhere

A circular letter sent out by the Western Union Telegraph Company to the managers of its offices in the country, says that arrangements have been made with the American Telephone and Telegraph Company and its subsidiary exchanges for a certain definite telephone number for its offices all over the United States.

The number selected is 4321, and the changes will be made in every town as rapidly as possible.

The company believes the scheme will become a great help to traveling men. They may go to the telephone in any town, village or city and without referring to the directory, call 4321, a very easy number to remember, and get the Western Union. It will also in time become an advertisement for the company.

Wireless for Taft Reception

A novel feature of President Taft's reception in Chicago was the wireless telephone on the platform erected for the photographers. E. M. Taylor, one of the Collins Company's experts, boarded the President's train at Fort Wayne.

Before the train reached Thirty-third street, after the Englewood stop, the wireless telephones got into communication and the President was welcomed to Chicago. Several of the reception committee used the telephone, also General Grant and his staff, ex-Mayor Dunne, Governor Deneen and others.

The President is much interested in the invention and warmly thanked Henry W. Lee, the local demonstrator, for arranging to equip his suite at the LaSalle Hotel with the wireless telephones.

The Ohio Independent Convention

SOMETHING over two hundred representatives of the independent telephone companies of Ohio attended the annual convention of the Ohio Independent Telephone Association held March 17 and 18 at the Hotel Hartman, Columbus. Almost the entire day was spent in a discussion of the influence of the Morgan control of the leading companies of the state.

President Frank L. Beam, of Mt. Vernon, occupied the chair and made a few remarks at the opening of the meeting. Mayor Marshall and J. Y. Bassell, secretary of the Chamber of Commerce, made addresses of welcome, to which Attorney Harry M. Daugherty responded. President Beam then delivered the annual address, and the reports of Secretary O. O. Welsheimer and Treasurer Ralph Reamer followed.

Frank A. Davis of Columbus, president of the Columbus Citizens' Telephone Company and the United States Company, and general manager of the Morgan telephone interests, made a full and frank exposition of the position of the Morgan firm in the Ohio field. He declared that while he did not expect now to convince the doubting independents that the men whom he represented were wholly devoted to the independent telephone movement, yet he was willing to let the verdict rest with time and that the final verdict would be that J. P. Morgan & Co. were the firm allies of the other Ohio independent companies.

He said that only after he had been given every assurance of the continued independent affiliations of the companies did he consent to take charge of them and that he had been given free rein in their management, even to the choosing of his own boards of directors.

In regard to the long-distance company he said that it would be operated in the interests of the independents and to show good faith in this he asked that the convention appoint a committee of five or seven men to assist in making a new schedule of rates for long-distance business. He pledged himself and his company to a strict adherence to the schedule, which this committee should formulate. He said that already the suits which seek to conserve the exclusive long-distance contracts of the United States Company had been fixed for early hearing and these would be pushed with all possible vigor.

In regard to the Elson bill, he said he had never taken any part in the discussion of it because he did not desire to become involved in any question upon which the independents were divided, but personally he was opposed to the bill as an independent telephone man, and in support of his assertion that neither he nor the men whom he represented were behind the bill he showed that managers of the Morgan companies were among the most bitter opponents of the measure.

Judge W. H. Brucker, of Mansfield, chairman of the executive committee, declared that the transaction by which the independent lines passed to the control of the New York firm was a ruse to hide the actual ownership of the Bell companies.

Frank H. Woods, of Lincoln, Neb., president of the National association, made a very interesting address. He emphatically denounced the Elson bill, which, he said, would kill the independent business in Ohio, if enacted. G. R. Johnson, general manager of the Columbus system, said that if the consolidation of toll lines is legalized through the passage of the Elson bill, the local independent companies will be at the mercy of the long-distance monopoly because the latter would be able to dictate terms. Mr. Woods also argued against the measure for other reasons, and insisted that the business is in better shape now than it will be if the proposed measure is passed in its amended or any other form. Resolutions were adopted condemning the bill as a measure intended to strangle the small companies by giving control of the toll service to a long-distance monopoly.

Another resolution adopted contained a request to the General Assembly to enact legislation forbidding rate discrimination for the purpose of bringing about ruinous competition. It was charged that the Bell companies had pursued a policy of cutting rates in order to compel small companies to go out of business. After a lively debate, a resolution was adopted indorsing a state commission with full power to regulate the telephone business.

H. P. Folsom, of Circleville, spoke on "Comparative Tax Valution of Telephone Property," and W. L. Laubach, of Akron, on "Reconstruction." At the banquet in the evening G. P. Thorp, of Wilmington, acted as toastmaster, with the following responses: "The Ultimate Consumer," Daniel J. Ryan, Columbus; "Shooting Trouble," Harry C. Devins, Cleveland; "A Live Wire from Mansfield," Judge Lewis Brucker, Mansfield; "What I Don't Know About the Telephone Business," Albert Reese Davis, Cleveland.

At the convention it was decided to change the organization of the association so that a board of directors of seventeen members shall have full charge of its affairs, all officers and the executive committee being selected by this board. The first meeting of the newly-elected board was held, but nothing was done beyond the selection of S. E. Ward of Mansfield as chairman and G. R. Johnston of Columbus as secretary. The full board met at the Chittenden hotel March 23, when the officers of the association were elected and a committee appointed to confer with F. R. Davis, president of the United States Telephone Company, on a new schedule of long-distance rates, as suggested by Mr. Davis in his address before the convention.

Frank L. Beam was elected president of the association, H. P. Folsom was elected secretary and Ralph R. Reamer, of Columbus, treasurer, a place which Mr. Reamer has filled for several years. The executive committee, which under the new method of organization will have much to do with the affairs of the association, is composed of the president, S. E. Ward, W. D. Rush, H. P. Folsom, D. J. Cable and C. Y. McVey. The board took up a number of other matters in addition to the election of the officers and the question of the schedule of long-distance rates was discussed and a committee will be appointed to take up this question with President Davis of the United States Telephone Company, as suggested by him at the annual convention.

The meeting of the board was most harmonious and showed that the independent telephone men of

the state are now closer together than they have been for several years. Several questions which have been agitating them were satisfactorily settled at the convention and from this time the independents say that they are going to have full confidence in each other and work for the common interests of the independent telephone companies of the state.

Both the convention proper and the meeting of managers took occasion to rap the Elson bill, which has passed the house and is now pending in the senate, and every member of the general assembly was sent a letter urging him by the unanimous vote of the independent telephone men of the state to oppose this measure in every form in which it may come up.

How to Read Telephone Circuit Diagrams

By David S. Hulfish

Copyright 1910 by the Electricity Magazine Corporation.

LESSON XV.

AN electrical conductor is represented in a diagram usually by an unbroken line joining the points of apparatus between which the conductor extends. See Fig. 511. This symbol for representing a conductor does not suggest the material from which the conductor is made, nor the distance between the points represented at the ends of the conductor, and which are joined by the conductor.

A conductor seemingly very short in a diagram may be of considerable length when the wiring of the actual apparatus is studied. To suggest length, the symbol of Fig. 511 is modified as shown in Fig. 512, wherein the dotted portion of the line indicates distance. Such a broken portion usually is found in conductors leading from a central office to a substation, or in conductors leading from symbols for equipment located in one central office to symbols for apparatus located in another central office.

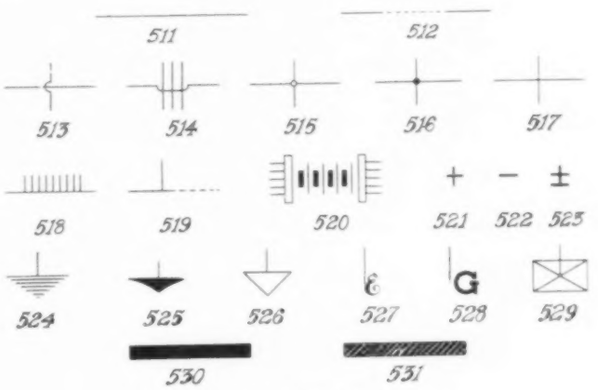
As conductors are drawn in a diagram, it becomes necessary to cross them in many places; hence a convention has been adopted to indicate that two wires which cross are not connected electrically. This convention is the half-circle jump of Fig. 513. When a group of wires is to be crossed, the jumping wire sometimes is drawn in a single displacement to cross all of the group, as shown in Fig. 514. This renders the conductor which jumps more easily read, but the conductors which are jumped, particularly in the middle of the group, do not show so clearly when they are being traced that the crossing wire is a jumping wire.

When conductors are electrically joined, a small circle or a solid black dot is used; this might be thought of as the symbol for a soldered joint. A branching wire, as in Fig. 519, is clearly a case of electrical joining; the dot or circle symbol of Fig. 515 or 516 usually is used, and is not out of place.

Where wires cross without any indication, the diagram must be studied to determine the draftsman's rule. Perhaps he is using the symbol of Fig. 513 but not of Figs. 515 and 516; perhaps he is using a symbol of Figs. 515 or 516 but not that of Fig. 513. (See Fig. 532).

A wire which branches to many points is called a 'bus wire, sometimes written bus wire or improperly buss wire, an abbreviation of "omnibus" wire, or wire for all purposes. The symbolization of such wires is shown in Figs. 518 to 529. The heavy battery terminals symbolized in Fig. 520 are called 'bus bars, rather than 'bus wires.

In lieu the symbol of Fig. 520, or in any source of current or constant potential, the 'bus wires or 'bus bars connecting to either terminal may be indicated by the sign indicating the polarity of the terminal to which they connect. Thus, in a diagram where a battery and a ringing generator is shown, the symbol of 521 adjacent to the terminal of a wire indicates that the wire entends to the positive terminal of the battery; that is, the symbol of Fig. 521 may be interpreted as a symbol for a 'bus conductor. Likewise, the symbol of Fig. 522 is the symbol of the 'bus conductor connected to the negative terminal of the battery, and the symbol of Fig. 523 is the symbol of the 'bus wire of the alternating-current source, or ringing generator. The earth conductor is indicated by symbols in similar manner, some of the symbols used being given in Figs. 524 to 529, inclusive.



Figs. 511 to 531. Symbols for Conductors.

Fig. 524 gives the symbol most frequently used for the earth conductor. Figs. 525 and 526 are modified forms less frequently met. In Figs. 527 and 528, the *E* abbreviates the word "earth" and *G* abbreviates the word "ground." Fig. 529 is an earth symbol which has been used much in diagrams pertaining to art of telegraphy.

Contrasting with the symbols for conducting mediums, the symbols of Figs. 530 and 531 are for insulating mediums. Fig. 531 represents section of insulation, where the section is one of considerable area in the drawing; where the section is of small area, the solid black of Fig. 530 is employed. For surface or elevation of insulation, solid black is employed except where the surface is large, in which case it is shown white.

Fig. 532 is a figure selected to show the crossing

of conductors in a diagram. In the upper portion of the figure, there are several instances where one conductor crosses another without contact, and the convention of Fig. 513 is observed. In the lower portion of the figure, however, the crossing conductors form such a maze that the use of the same convention would only render the conductors more difficult to trace; hence it is abandoned and the lines are drawn straight. This figure offers also a specimen diagram for elementary practice in circuit tracing. At the left, the pairs of terminals are terminals of telephone lines, as indicated by the apparatus associated with pair No. 1. Assuming that the substation telephone is placed across the line conductors of that pair, circuit is completed through the battery, relay *r*, the line conductor, the substation (not shown in the diagram), the return line conductor, relay *R* and earth to the battery again. This energizes relays *r* and *R*. By the closing of their

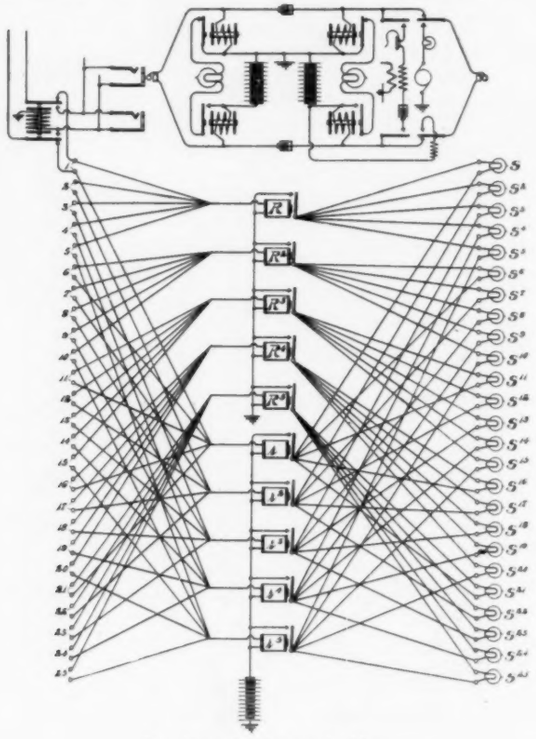
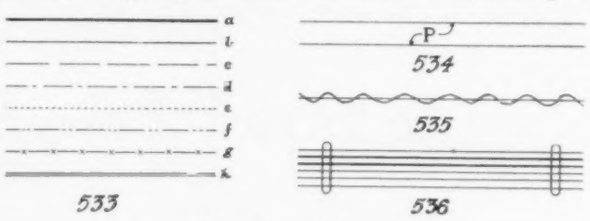


Fig. 532. Conductors in Mass.

armature contacts, a circuit is closed including the battery and lamps. In like manner, a closed path between any pair of terminals at the left will energize two relays and cause the corresponding lamp at the right to glow. It is interesting also, but more difficult, to trace the current which flows through lamps other than the one which is intended to glow, by an inherent defect in the theory of the circuit, and also to discover the results upon the lamps when any *two pairs* of terminals at the left are bridged at the same time, as by two telephone substations calling the switchboard at the same time.

The "coding" of conductors in a circuit diagram consists of specific modification of the conductor symbol to indicate the purpose for which the conductor is used. Figs. 533 to 536 show some codes which have been used.

Most widely used of all coded conductors is the heavy conductor for the "talking pair;" that is, for the wires which carry the speech currents of a telephone conversation. This is seen in Figs. 548 and 549. By this distinction, it is easy to follow the "talking circuit" through the diagram, and to recognize it whenever any signal wire is traced into operating re-



Figs. 533 to 536. Coded Conductors.

lation to it. The same principle is extended to other wires, particularly in wiring diagrams.

Fig. 533 shows a code of conductors to illustrate the principle, extended to conductors of several classes. While the different line values may be assigned to different classes, arbitrarily, the following list will be typical:

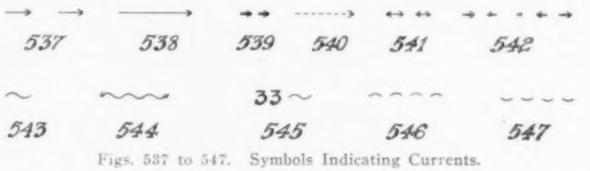
a—Conductors carrying speech currents of conversations between subscribers.
b—Conductors carrying signaling currents individual to a specific signal device.
c—Battery 'bus, live side or ungrounded side.
d—Battery 'bus, grounded side of battery.
e—Alternating-current, ringing leads, 'bus wires.
f—Signaling circuit, common to more than one signal.
g—Interrupted current, or pulsating current 'bus wires.
h—A derived circuit upon the speech conductors.

The above line values and their code as given are observed in Fig. 549. The code for the calling plug's equipment sometimes differs from the code for the answering plug's corresponding equipment.

Fig. 534 shows the symbol for a twisted pair; the two wires indicated by the *P* are twisted together either in a single duplex wire or in cables. *T* may be found instead of *P* or sometimes *TP*. The symbol of Fig. 535 also indicates that the two conductors are a twisted pair and insulated from each other.

In Fig. 536 the symbol is the loop surrounding the group of parallel conductors. This indicates that the conductors enclosed within the loop from a cable in the wiring of the apparatus.

A flow of current, without any showing of the absolute value of the current, has been indicated by



Figs. 537 to 547. Symbols Indicating Currents.

arrows placed near the conductor. For discrimination between currents, either simultaneous or at different times, the arrows vary in size and shape. Arrows for alternating currents either point in both directions or are curved.

Figs. 537 to 540 are symbols indicating that direct

current flows in an adjacent conductor; the arrow heads sometimes are found drawn upon the conductor instead of adjacent thereto. Figs. 541 to 545 are symbols for alternating current in an adjacent conductor. The arrow points are omitted from the symbol of Fig. 543, and in Fig. 545 the frequency is indicated by the figures, the current value being not shown. Speech currents are indicated by the alternat-

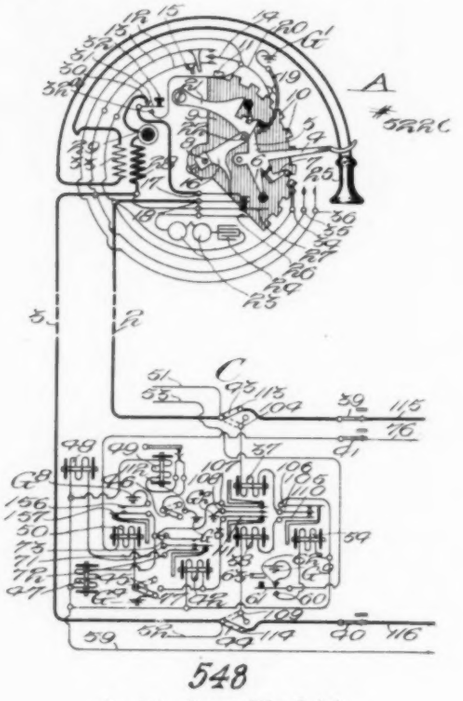


Fig. 548. Patent Office Labels.

ing current symbols. Figs. 546 and 547 are suggested symbols for pulsating current, positive and negative, respectively.

That the different parts of a drawing or diagram may be referred to definitely, identifying the part without possibility of error, labels sometimes are placed upon the drawing adjacent to the different parts. These labels may consist of complete words, or of abbreviations, letters or figures. Usually a "leading line" extends from the label to the particular conductor or apparatus part to which the label pertains. This system of labels is common wherever a written description accompanies the drawing or diagram, and is universal in patent office drawings. Fig. 548 is an excerpt taken as a horrible example from a patent in which the principle of labeling the diagrams was carried to absurdity.

Fig. 549 presents a detailed wiring diagram for a pair of plugs upon a common battery switchboard of a specific type. Accompanying the wiring diagram, at the top of the figure, is the skeleton diagram.

From the skeleton diagram it is seen at a glance that the two plugs are connected through a repeating coil which feeds current to the talking conductors; that a double-action key rings upon the calling plug or permits the operator to listen upon the pair; that mechanical visual signals are used and that they are displayed continuously while current is flowing to the talking conductors; that the bodies of both of the plugs are connected to the main battery, presumably for busy test purposes.

The wiring diagram shows that the answering plug is behind or "back" of the calling plug; that each plug is connected by a flexible cord to a set of three terminals, marked *T, R. S;* that in the connecting rack of the switchboard where the cords are attached the tip terminal is top, the ring terminal is middle and the sleeve terminal is at the bottom of the set of three. It shows that the two supervisory relays are mounted one above the other, the answering-plug relay being the upper one; also that the two signals are similarly mounted and related; probably also the signals are higher in the switchboard frame than the relays. It shows also many fuse mounts and fuses which are not indicated in the skeleton, and many terminals. The terminals are accompanied by labels indicating their use, and those labels probably would be found stamped in the switchboard adjacent to the respective terminals; this is true also of the labels adjacent to the fuse mounts, and upon the relays, and signals.

Many details of the wiring of the switchboard are disclosed very definitely when the coding and branching of the conductors are studied carefully.

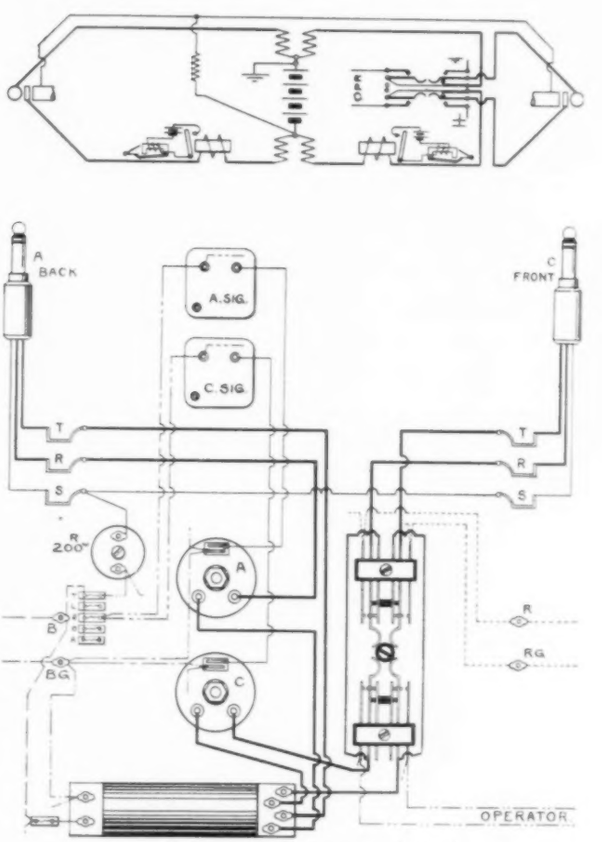


Fig. 549. Wiring Diagram, with Skeleton.

The talking wires of the figure are all individual to the pair of plugs shown, there being of course other pairs, in each of which the talking wires are individual to the pair, no talking wire being common to any two pairs of plugs. These wires are drawn heavy, according to code *a* of Fig. 533. The respective

terminals of the repeating coil, at the lower edge of the diagram, are identified by the locations of the terminals, and the same is true of the relays and key terminals. The view in the wiring diagram of the relays *A* and *C* is taken such that the terminals are fully identifiable; the remaining characteristics of the relays are unimportant to the matter of installing or supervising the connecting wiring. The function of the relay is left to the skeleton diagram.

The battery connection for the repeating coils extends from the terminal *B* by a single wire in *C* code to the fuse of the cord pair illustrated, thence onward to other similar fuse mounts, as is indicated by the *c* code line branching downward from the left end of the fuse. The fuse is connected to the repeating coil terminal by a *b* code line, indicating that the connecting wire and therefore the fuse itself is individual to the repeating coil, and not common to two or more repeating coils.

The ground connection to the repeating coils extends from terminal *BG* (probably "battery ground") to the repeating coil terminal and then branches downward in *d* code line to other similar terminals.

The fuses *T* (test), *L* (line signals), *S* (supervisory signals) *O* (operator's telephone current supply), and *A* (alarm circuit) are connected to the *B* battery terminal by a wire other than that which leads to the repeating coil fuses.

From the test fuse *T* leads a 'bus wire in *f* code to a terminal of the resistance coil labeled *R* and then continuing to other similar coils, as indicated by the branch wire still in *f* code. From each of the resistance coils an individual signal wire (*b* code) leads first to the sleeve terminal of the answering plug, then to the sleeve terminal of the front or calling plug. The wiring diagram shows clearly therefore that each plug pair has its own resistance coil for test.

From the fuse *S* two 'bus signal wires (*f* code) extend to the answering and calling signals respectively, each serving all of the answering and all of the calling signals of the switchboard, respectively. This is shown by the branch wires in *f* code which lead to the right from the terminals of the signals illustrated.

In the relays *A* and *C*, for some reason known only to the maker of the diagram, it is instructed by the diagram that a 'bus wire from the terminal *BG* serve all of the *A* relay contacts and a similar but separate wire serves all the *C* relay contacts. As there is no interposed apparatus, these wires are drawn in *d* code. It would seem that *f* code would have been appropriate.

The *A* relay contact is connected to the *A* signal by an individual signal wire (*b* code); the same is true of the *C* relay contacts and the *C* signal.

The ringing 'bus wires (*e* code) are brought from the power board to the terminals *R* and *RG*. Thence, the pair is taken to the indicated terminals of the key illustrated and then to the analogous terminals of similar keys, as indicated by the branching wires (*e* code) leading to the left.

The operator's circuit, in the lower corner at the right, is drawn in *f* code, indicating a common signaling circuit. While these wires carry speech currents, they do not carry speech currents between subscribers in conversation. For this distinction, they are drawn in *f* code rather than in *a* code. The operator's circuit also passes from key to key, as indicated by the branching wires at the terminals of the key illustrated.

The wires from terminals *B* and *BG* to the left and to the power board, and from terminals *R* and *RG* to the right and to the power board, will be found in detail in the power plant wiring diagram.

The wires connecting to the line-signal fuse *L* will be found in detail in the wiring diagram of the line circuit.

The extension of the circuit marked *Operator* will be found on the wiring diagram of the operator's circuit, in which circuit diagram will appear also the fuse *O* and its proper connections.

The fuse *A* and the unconnected terminals of the signals *A* and *C* will be found provided for fully in the wiring diagram for alarm circuits.

It is possible that for some switchboards all the circuits of the switchboard may be represented in a single complex wiring diagram, but the separation of the wiring diagram into parts as indicated above is the form most likely to be encountered.

(To be continued.)

Telephone Development in Cuba

"The development of telephone communication in and around Lima is particularly noticeable to a stranger," says Edgar W. Dennison, secretary of the Publicity League of Cuba.

President Jose Miguel Gomez recently signed a decree authorizing the Cuban National Telephone Company to install and operate local and long distance telephone service in the six provinces of the island, namely, Pinar del Rio, Havana, Matanzas, Santa Clara, Camaguey and Oriente, or Santiago de Cuba.

The decree stipulates that long distance lines shall be in operation between the city of Pinar del Rio on the west, Havana and the city of Santiago de Cuba on the east, within eighteen months from April 21 of this year. The following year the lines are to be extended to Baracoa, an important mining section along the north and south coast of Oriente province. The company has named in the decree over three hundred cities, towns and villages on the island. It may, however at its option add any points desired, even if not specifically designated in the decree. For the past ten years the Reo Telefonica, the old company, has been trying to secure a telephone concession for the installation of this modern business aid and developer.

Mr. Dennison visited the island for the first time in 1899 for the purpose of investigating the telephone situation. The Reo Telefonica was acquired by the interests he represented and this company was made the basis on which to start the plans for local and long distance telephone extension throughout the island. These efforts were unsuccessful, however, except in the installation of the electrical subways in the city of Havana and the erection of a concrete three-story building for telephone headquarters in the city of Havana, being planned to contain local equipment for the city of Havana, with capacity for 18,000 stations, as well as the required long distance apparatus to meet the required conditions.

The automatic development in telephony seemed so important a factor in the art today that the automatic system was adopted for the island in connection with the manual operation for the long distance service.

Telephonic Intelligibility

By George A. Campbell*

IN the August, 1908, number of the *Philosophical Magazine* a paper by Lord Rayleigh contains some notes upon the acousticon, in the course of which he says:

"The reproduction of speech, given at about one foot away from the microphone, was better than anything I had ever heard before. The first impression was that all the consonantal sounds were completely rendered, but this turned out to be an illusion. In listening to the numerals, given in order, the observer would feel confident that he heard the *f* in *five* and the *s* in *six*. But if the initial sound was prolonged—*f f f ive, s s s ix*, the observer could not tell until he heard the sequel which it was going to be. Further, if the sounds were given as *s s ive, f f ix*, they were heard normally as five and six. It was plain that there was no difference in the rendering of *f* and *s*. I am informed that this is a well-known difficulty in ordinary telephoning, and that in spelling a name containing *f* or *s* it is usual to say '*f* for Friday' or '*s* for Saturday.' But the articulation of the acousticon is so superior that it was surprising to find the failure complete. The characterization of *sh* was not much better, though after a little practice I could distinguish it from *s* or *f*, but probably only by a greater loudness.

"These failures might have been ascribed to my rather defective hearing, but other observers with normal hearing did no better."

This statement of telephonic intelligibility is typical of the impression made by the general use of the telephone. Most of us feel that we understand almost everything transmitted by the telephone or next to nothing, according as we are listening to a familiar voice talking upon some well-known subject, or as we are obliged to listen to disconnected syllables spoken possibly in a strange tone of voice. This is obviously a case for the statistical analysis of results.

Some time ago the American Telephone and Telegraph Company began an investigation of the distortion introduced by the telephone instruments and transmission network. The work has not advanced sufficiently to warrant general statements as to the telephonic intelligibility of the 5,000 phonetic syllables employed in the English language, but what has been done seems to show the order of intelligibility of the consonantal sounds with some definiteness.

The telephonic network included regular common battery subscribers' sets at each end, common battery transformers and cord circuits at the central offices, and a line of about one hundred miles of loaded No. 16 or No. 14 B. & S. gauge cable, with the addition of from three to sixteen miles of non-loaded No. 19 B. & S. gauge cable. The series of tests over this connexion included twelve thousand records.

For comparison, tests were also made with direct transmission through the air, the same observers facing each other with no intervening obstruction but not looking at each other. The observers were fifteen feet apart in a quiet room. This series contained two thousand records.

For the tests which will be described the following twenty syllables, each ending in long *i* and preceded by one of the simple consonant sounds, were used:

bi as in	bee	ni as in	knee
chi	Chi(le)	pi	pea

CALLED

RECORDED	*f*	*s*	*h*	*sh*	*ch*	*k*	*t*	*p*	*j*	*g*	*d*	*b*	*y*	*v*	*th*	*z*	*m*	*n*	*l*	*r*	Total.
f	97 48	20	1	5	1			1	0			1		0	0		0				77
s	34	100 69	28	10 17	2 3	0		2	1			2		3	1	1		0	0		100
h	0	0	99 45	8	2	0		1	1	0				0	0						58
sh	0	4	1	88 33	1				0												39
ch	1	5	9	2 35	97 41			0	5	1 0	0		0	0	0					0	96
k	1	0	1	0	45	100 45	4	1	3	7					1						108
t	6		2	0	5	49	98 70	45	4	11	2	1	0	0	1 1	0	0	0			197
p	2 3		1	0	1	5	1 25	100 45	0	0	3	4		0	0				0	0	87
j	0		2		1 1	0		0	87 61	12 10	0		1	0	0	2					77
g			2		0	0			13 17	87 47	1 0				0	1	0				67
d	1	0	1			0	0	4	1	23	97 91	40	1	2	3	0		0			169
b	1 1		1 1				1 0	1	0	1	2 3	96 48		4 1	1 1	0	1	1		0	88
y		0	3						2	0			98 76	0	1 0	0		1		0	84
v	2	1	1			5	0	1	1	0	0	3	1 9	90 41	5 24	7	0	0	0	0	91
th	0				1		1			0		1	1 2	0 82	88 41	11	0				93
z	1	1	2	0	0		0	0	1	0		1	4	10	25	100 72		0			127
m		0	1	0	0						0		2		0		100 90	5 67	1		162
n	0														0		3	94 24	1 0		27
l	1	0	0	0	0	0	0			1	0	0	0	3	1	2		5	1 0	99 98	7	125
r	0						0	0	0	1	0			1	0		0	0		1	100 92	96

Table I.

di	de(pot), dee	ri	re(bus), rei
fi	fee	si	see
gi	Gi(zeh)	shi	she
hi	he	ti	tea
ji	gee	thi	the(ory)
ki	key	vi	ve(nus), vee
li	lee	yi	ye
mi	me	zi	ze(bra), zee

The list contains seventeen words and three syllables which occur in compound words. According to the scientific alphabet used in the Standard Dictionary,

*Philosophical Magazine.

CALLED

	f	*s*	*h*	*sh*	*ch*	*k*	*t*	*p*	*j*	*g*	*d*	*b*	*y*	*v*	*th*	*z*	*m*	*n*	*l*	*r*	Av.
Correct	97	100	99	88	97	100	98	100	87	87	97	98	98	90	88	100	100	94	99	100	96
1st incorrect	*p* 2		*b* 1	*s* 10	*s* 2		*b* 1		*g* 13	*j* 12	*b* 2	*v* 1	*v* 1	*th* 6	*v* 8			*m* 5	*n* 1		3
All others	1	0	0	2	1	0	1	0	0	1	1	0	1	4	4	0	0	1	0	0	1

CALLED

		f	*s*	*h*	*sh*	*ch*	*k*	*t*	*p*	*j*	*g*	*d*	*b*	*y*	*v*	*th*	*z*	*m*	*n*	*l*	*r*	Av.
Correct Records		48	69	45	33	41	45	70	45	61	47	91	46	76	41	41	72	90	24	98	92	59
Incorrect Records.	1st	*s* 34	*f* 20	*s* 28	*ch* 35	*k* 45	*t* 49	*p* 25	*t* 45	*g* 17	*d* 23	*b* 3	*d* 43	*v* 9	*th* 32	*z* 25	*th* 16	*l* 5	*m* 67	*m* 1	*l* 7	26
	2nd	*t* 6	*ch* 5	*ch* 9	*s* 17	*t* 5	*p* 5	*k* 4	*d* 4	*ch* 5	*t* 11	*p* 3	*p* 4	*z* 4	*z* 19	*v* 24	*v* 7	*n* 3	*l* 6	*r* 1	0	7
	3rd	*p* 3	*sh* 4	*y* 3	*h* 8	*s* 3		*th* 1	*s* 2	*t* 4	*j* 10	*t* 2	*v* 3	*l* 3	*d* 2	*d* 3	*j* 2	*b* 1	*b* 1	0	0	3
	All others	9	2	15	7	6	1	0	4	13	9	1	7	8	6	7	4	1	2	0	1	5

Table II and III.

there are but twenty-four elementary English consonant sounds. All of these consonant sounds are included except *dh, ng, w,* and *zh; dh* is somewhat like *th,* and was similarly recorded in an earlier series of tests; *w* was recorded correctly in 99 per cent of the cases in a set of twelve thousand records; *ng* and *zh* are not of frequent occurrence, and do not seem to be used as syllables with merely long *i* following.

Ten lists of one hundred syllables each were prepared, every one of which contained the twenty consonants five times in a perfectly haphazard manner. All of the ten lists were spoken over the telephone connection and a record made of the consonant heard. The tests were then continued, the experimenters changing places. All records were made in a quiet room and over quiet lines. Before this series of tests was begun the observers had made at least fifteen thousand records, and had become perfectly familiar with the method of test. The syllables were never repeated for any one given record, and the observer always made a record however uncertain he might feel as to its correctness. While the sequence of the lists and of the syllables was perfectly haphazard, the observer knew that each syllable occurred the same number of times in each list of one hundred syllables. This may have led in some cases of uncertainty to recording a syllable merely for the reason that it did not seem to have received its proper share of records. It does not seem probable that this influenced the results to any considerable extent. As far as such an effect occurred it would correspond in a general way to the condition obtaining in the practical use of the telephone, where the subject matter and the preceding syllables give some clue as to the syllable which may be expected.

Table I shows the distribution of all records. Where there are two figures in a square the upper refers to the test made through the air. The syllables have been arranged in such an order as to bring those which are most frequently mistaken for each other as near together as possible. This brings the surds or voiceless consonants, *f, s, h, sh, ch, k, t,* and *p* together. The remaining consonants are all voice consonants with the exception of *th.* The occurrence of *th* among the voice consonants may be accounted for by the fact that *th* is liable to confusion with the voice consonant *dh* as in *thee,* and it is possible that in these tests the distinction between the two was not properly made. In an earlier series of tests which included *dh* in place of *th* the same mistakes were made as in the present series with *th,* that is, *dh* was confused with *v* on one side and *z* on the other. In the table the voiceless explosives *k, t* and *p* come together, also the voice explosives *g, d* and *b,* and the nasals *m* and *n.*

A blank square indicates that no record was made by either observer corresponding to that case. The table shows 156 such squares, and therefore of the possible incorrect cases only 59 per cent occurred. A zero indicates that not over one-half of one per cent of the total records for that syllable fell within that square. Had the distribution of records been entirely haphazard the average number in each square would have been 5 per cent. The table actually shows only 34 squares with 5 per cent or more incorrect records, therefore only 9 per cent of the incorrect cases occurred with a frequency equal to or greater than the probability corresponding to a perfectly haphazard distribution of records. The consonants may be divided into three groups, as indicated by the heavier lines in the table, which are sufficiently distinct so that no consonant in one group is mistaken for any consonant in the other groups as frequently as 5 per cent of the time.

The totals in the last column of Table I show that the records were not evenly divided among the twenty syllables. Thus *knee* was recorded only 27 per cent as many times as it was called, while *tea* was recorded nearly twice as often as called. The scattering of the records increases somewhat with the total number of records, but not proportionately.

In general each consonant was much more frequently mistaken for some one consonant than for any other. Table II gives the correct records and the leading mistakes for transmission through the air, and in Table III the same records are given for telephonic transmission. The last columns of these tables show that 96 per cent of the records were correct for transmission through the air, and 59 per cent correct for telephonic transmission. The leading mistake made for air transmission occurred in 3 per cent of the cases (total correct and incorrect records), while for telephonic transmission the leading mistake

	Me.						Knee.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	66	86	96	96	86		38	68	72	81	65	
F	80	92	70	68	77		80	88	92	68	82	
G	78	90	92	56	79		88	98	96	82	91	
H	94	96	82	90	90	100	86	98	96	92	93	100
I	52	54	54	78	59	94	50	84	76	74	71	100
J	60	88	72	84	76	90	46	72	71	64	64	98
					78						78	
	Am.						An.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	84	64	86	52	71		70	78	62	90	75	
F	64	76	84	78	75		64	52	50	64	57	
G	76	74	66	54	67		92	88	94	66	85	
H	90	94	88	82	88	98	90	98	98	92	94	94
I	68	62	72	74	69	96	96	94	96	96	95	84
J	80	80	64	76	75	92	90	84	84	86	86	68
					74						82	

Table IV.

Ohm.							Own.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	82	88	66	94	82		68	66	88	54	69	
F	84	86	72	86	82		90	90	92	94	91	
G	96	88	86	90	90		74	82	98	94	87	
H	94	80	82	96	88	76	96	90	94	86	91	80
I	76	82	64	76	74	72	96	88	98	88	92	82
J	80	80	68	90	79	90	94	90	92	96	93	84
					82						87	
Fee.							See.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	70	94	98	44	76		74	96	74	98	85	
F	54	90	80	40	66		74	62	96	92	81	
G	90	80	94	76	87		76	96	96	90	89	
H	68	62	76	60	66	100	82	82	90	66	80	98
I	66	70	84	70	72	100	66	44	62	66	59	100
J	66	78	88	86	79	100	68	64	60	74	66	100
					74						77	
Fix.							Six.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	92	100	92	58	86		92	84	92	78	86	
F	88	96	96	72	88		76	84	94	90	86	
G	94	96	94	78	90		86	88	98	78	87	
H	86	70	64	58	69	100	80	80	80	68	77	100
I	76	66	78	78	74	100	88	80	86	70	81	100
J	88	86	96	90	90	100	80	60	74	84	74	96
					83						82	
Five.							Sive.					
	A	B	C	D	Av.	E	A	B	C	D	Av.	E
E	90	100	100	94	96		86	92	92	92	90	
F	100	98	100	100	99		88	100	96	100	96	
G	94	96	96	78	91		82	98	92	100	93	
H	99	100	68	78	85	100	72	80	90	96	84	98
I	60	74	90	70	73	100	64	70	82	82	74	100
J	96	86	100	94	94	100	70	60	70	96	74	98
					90						85	

Table IV—Continued from Page 162.

amounted to 26 per cent of the cases. The mistakes made through the air were also made over the telephone, but additional mistakes also occurred, and often these are the more frequent ones. The most common mistake made over the telephone was in recording *me* when *knee* was called. This occurred in 67 per cent of the cases when *knee* was called. *Knee* is thus naturally the syllable least often recorded correctly, occurring in only 24 per cent of the cases. *Lee* was recorded correctly in 98 per cent of the cases, a record excelling the average for direct transmission through the air.

The records tabulated in the above tables were all made by Mr. W. L. Richards and Mr. E. C. Molina. They differed considerably in the distribution of records, but presumably the averages are about normal as far as the personal element goes. With the best possible articulation the intelligibility would undoubtedly be considerably higher.

Our tests indicate that the greater part of the distortion occurs in the subscriber's set, and that a short length of line may actually improve intelligibility as compared with zero line. As the length of line reaches the commercial limit the intelligibility gradually falls off. The tests indicate, as would be expected, that changes in the telephone apparatus and the line affect the different syllables quite differently.

It will be seen that the syllables *fee* and *see* are confused with each other in telephonic transmission. They were interchanged in 27 per cent of the cases, and recorded correctly in 58 per cent of the cases, which makes *f* and *s* an average pair of consonants as the twenty consonants were recorded correctly in 59 per cent of the cases, and the leading mistake was made in 26 per cent of the cases. Even as the records stand, it will be seen that *f* and *s* are correctly recorded twice as frequently as they are interchanged with each other. While these results are not directly applicable to the acousticon, which is the instrument referred to by Lord Rayleigh, the difference should be in favor of the acousticon, for our tests were made with commercial instruments over long commercial lines.

As the conditions of our tests differed from those of Lord Rayleigh in almost every particular, further tests, summarized in Table IV, have been made which bring the conditions more nearly into agreement. The number of syllables in each list was here reduced to two, and the six distinct series of tests included Lord Rayleigh's test syllables—*five* and *sive; fix* and *six*, and also *fee* and *see; ohm* and *own; am* and *an; me* and *knee*. Each list contained one hundred syllables, and was varied each time it was called. The lists were called over the telephone by six persons, here designated as E, F, G, H, I, J; of these I and J were young women. Four telephone receivers were arranged in series, parallel at the receiving station, and four persons—A, B, C, D—listened simultaneously and made independent records. This method materially reduced the time and labor of making this set of 14,400 records, and it also enables us to compare directly the records of different observers with any one person calling or of any one observer with different persons calling. Observer E listened directly to H, I and J, and these records are added to the table. The ten persons who assisted in these tests were familiar with the use of the telephone, but they had had little or no practice in syllabic tests. The telephone connection from the talking to the listening station was made through the private branch exchange of the office, and therefore the length of line included was almost negligible.

It will be seen that the records made by E for direct receiving through the air were in general nearly perfect, but that for "ohm" and "own" they were in some cases poorer than the telephonic records. Comparison of the original records for each calling of the lists shows that the distribution of mistakes was, on the whole, purely accidental, and could not be traced to definite irregularities in the pronunciation of the lists.

For Lord Rayleigh's syllables *fix* and *six*, *five* and *sive*, about 85 per cent of the records were correct; haphazard records would have averaged but 50 per cent correct. In one case, F calling and D recording, a perfect record was made for the "five-sive" list.

While it is obvious that the telephone seriously distorts speech-waves, nevertheless even those consonants which most nearly resemble each other are not distorted sufficiently to be indistinguishable.

Items of Legal Interest

By Ralph M. Loring

RIGHTS OF OWNERS OF WIRES

APPELLANT secured a permit to move a frame house along certain streets, and the permit contained the following restrictions: "This permit does not allow interference with wires or any other obstructions on the above route." *Held*, respondents having been lawfully in possession of the streets with their wires and lamps at the time of the issuing of the permit, appellant's right to the use of the streets was limited as provided by the permit, and that he possessed no legal right to interfere with the wires and lamps for the purpose of moving the house; that the trial court was justified in enjoining appellent from such interference, except upon the condition that appellant give respondent reasonable notice to remove its wires; and that appellant execute a bond to pay the reasonable expense thereof. *Edison Electric Light & Power Co. of St. Paul* v. *Bloomquist. Supreme Court of Minnesota.* 124 *Northwestern* 969.

EVIDENCE OF VALUE OF RIGHT OF WAY.

In an action brought in the exercise of the right of eminent domain for the purpose of condemning to the use of a telephone company a strip of land wholly within the limits of a public highway for use as a telephone and telegraph line, it is improper to admit evidence to the effect that an owner of land abutting upon the highway has been accustomed for a period of years to use for agricultural purposes a portion of the highway between the travel strip on the medium line of the same and his property line. The highway is dedicated to purposes of travel, and, in his use of it for agricultural purposes, the landowner was a trespasser without any right that can be recognized in law or considered of pecuniary value; and such testimony being entirely irrelevant and immaterial serves no purpose other than to improperly enhance in the minds of the jury the value of the strip taken and should have been excluded. *Tri-State Telephone & Telegraph Co. v. Cosgriff. Supreme Court of North Dakota.* 124 *Northwestern* 75.

INJURY TO LINEMAN.

Where an electric company owning several cross-arms on a pole used to support its wires had no independent system of inspection of poles, cross-arms, steps, etc., and plaintiff, a lineman who had been in the company's employ for some time, had no reason to believe that such inspection was made, he was required to make such tests himself as might be necessary to ascertain whether it was safe to go on the cross-arms, and could not recover from his employer for injuries sustained by a fall from the pole due to a defective cross-arm belonging to another electric company on which he stepped, and the breaking of which caused him to fall; there being no proof that the arm when originally placed in position was defective, or that his employer had any knowledge of the defect. *Maryland Telephone Co.* v. *Chambers. Court of Appeals of Maryland.* 75 *Atlantic* 241.

EVIDENCE OF INJURY.

Plaintiff, an employe of a telephone company, was injured by coming in contact with a telephone wire which had been heavily charged with electricity through contact with one of defendant's electric light wires. One of defendant's witnesses was asked if after the accident he had found one of the telephone wires resting on the light wire, and, on replying that he did, was asked if he removed that wire, to which he also answered that he did. *Held*, that the evidence was not inadmissible as being evidence of subsequent repairs, but was admissible as tending to show the condition existing before and after the accident, as well as the cause of the accident, and tending to show that, when the condition was changed, the trouble was removed. *Dow* v. *Sunset Telephone & Telegraph Co. Supreme Court of California.* 106 *Pacific* 587.

INJURY TO PEDESTRIAN.

A telegraph company sawed off a telegraph pole three feet above the ground, leaving the stump on the side of a path across the street in common use. A pedestrian at night veered from the path, and stumbled over the obstruction, and was injured. He was familiar with the surroundings, and undertook to keep within the path by reference to a tree and telegraph pole seen by him on the same side of the street as the obstruction was, and the relation of which, in point of location, to the tree and telegraph pole, were known to him. *Held* not to show as a matter of law that he was guilty of negligence in failing to exercise proper care in walking on the path, or that he was negligent in selecting the path for his route. *Dobbins v. Western Union Telegraph Co. Supreme Court of Alabama.* 50 *Southern* 919.

LINEMAN'S DUTY TO INSPECT POLES.

Where, in an action against a telephone company for injuries to a line-man while working on a defective pole, there was no evidence that the lineman was instructed to inspect the poles beneath the surface of the ground, and he showed that the company made systematic inspection of its poles by men employed for that purpose, and that its linemen did not make such inspection, and the company proved that the linemen made their own inspection, and that the lineman had been employed for six months, the question whether the company or the lineman was required to inspect the poles was for the jury, authorizing a recovery only on a finding that it was the duty of the company to make the inspection. *La Duke v. Hudson River Telephone Co. Supreme Court of New York.* 120 *N. Y. Supp.* 171.

REGULATION BY CITY.

It is the duty of a telephone company contemplating the exercise of the right granted by the state to ask the mayor and council to prescribe reasonable

regulations of the exercise of the right before placing any of their poles and structures on the streets and other public grounds of the city; but, if the mayor and council refuse to prescribe such regulations upon application, the company may build its lines upon the streets and alleys in such a manner as shall not incommode the public in the use of the streets and alleys so occupied, and the city authorities are not at liberty to treat the structures so erected as a nuisance. *New Hope Telephone Co. v. City of Concordia. Supreme Court of Kansas.* 106 *Pacific* 35.

USE OF CITY STREETS.

Under existing statutes, the right to build a telephone line in and over streets and highways is directly granted by the state, and the mayor and council of a city are powerless to prevent such use. The council has the authority to provide by ordinance reasonable rules regulating the use of the streets and alleys for that purpose by defining where and in what manner a telephone company shall erect and maintain its fixtures. *New Hope Telephone Co. v. City of Concordia. Supreme Court of Kansas.* 106 *Pacific* 35.

NEGLIGENCE.

A telephone company constructed a telephone line by means of pulleys and a rope strung along the top of the poles and running down, by means of the pulleys, along the side of the poles to the ground, where it ran through a pulley. While the work was going on, a child trespassing was injured by having his hand caught in the pulley. The work was not dangerous to bystanders, and the company did not warn the child. *Held,* that it was not negligent as a matter of law, as it could not reasonably have anticipated the accident. *Hall* v. *Missouri & Kansas Telephone Co. Kansas City Court of Appeals, Missouri.* 124 *Southwestern* 557.

What One Woman Thinks

By Sarah Elizabeth Brown

THE situation in Ohio doesn't seem to be a lot different from what it was in Iowa when telephone properties were changing hands. Somebody seemed to want the Iowa systems, and having the money they bought them. It also appears that somebody wanted the Ohio and Indiana companies and after fussing around for awhile they were purchased. When Mr. Brailey was the chief factor in the impending transactions, he was about as excited as our old brindle cow when we sold her calf, and from afar off it began to look like I would never get the thing straightened out in my mind. I remembered what Obediah had told me about a certain great speech Brailey had made at a banquet in Chicago, shortly after the Hot Springs system had been sold to the Bell. Brailey's speech pointed to the beauties of the telephone business and in his concluding flight of oratory he declared that all of his money was invested in independent securities and the only regret he had was the lack of it to make more and more investments in the same business. I naturally concluded that Mr. Brailey was an independent and that his operations were on the level. He maintained all along that he was acting for the good of the cause and now that it has evidently been accepted that way, I don't see why Brailey has been dropped out. But he has, all right, for the last act occurred at Columbus only recently, when he was still under suspicion by the rank and file.

* * *

I want to tell you how I have heard from Columbus. I have told you about our friend Ben Phelps. Well, Ben's oldest boy, Robert, is in his second year at school in Cleveland. Robert Phelps and our son John have been about as chummy as their fathers before them, except probably a little more keen for knowledge, because it seems to be quite the fashion now-a-days to know. Robert has spent his vacations at home and of course he has been chuck full of talk and explanations about his work, so John's mind has been fired with enthusiasm to go there. He has nagged away at us till we finally concluded it would be well for him to go and look the place over.

* * *

So he went, and now that he's home again, he is about as crazy to go back this fall as two tolerant parents can well stand. He has decided upon the mining course at Case college, because he thinks it covers everything but botany. We wondered how tney could teach mining on a fashionable avenue in a big city, but John says there is a big building full of mine and smelting machinery and another big building for chemistry and so on, and that the ores are shipped there in sacks for treatment. So we've decided he can go.

* * *

This may be out of place here, but it has a bearing on the subject, nevertheless, for while John was in Cleveland he heard of the Elson bill and the Columbus convention and there were so many trolley cars whirling around the soldiers' monument in the public square, that he flagged one and started for the convention. He knew his father would like to know how a telephone convention back east would act and he took the chance. I'm glad he did for I feel like I had been there myself, hearing it reeled off by John.

* * *

But after all, there doesn't seem to be anything to say after hearing what Frank Davis told that big throng of eager men who came to learn what had happened. John says that it was worth all it cost to hear Davis talk. He was so frank and earnest in his address—his reputation, locally—his long identity with the companies that have finally passed to Morgan & Company—his knowledge of the men who had him before them; all gave an atmosphere almost tragic in its significance. Mr. Davis had been expected. He was down on the program to tell about the Ohio situation of today, but he never touched it. He reviewed

the history of his own connection with the business and came down strong for more confidence in the future. The situation of today is plainly that J. P. Morgan & Company owns those exchanges and the U. S. Long Distance Company that were formerly known to be the bulwark of the Ohio and Indiana independent system. The question to accept or reject Morgan is still bothering everybody who hasn't sold and who would care to sell. After hearing from Mr. Davis, John says that no man would question his honesty, and it would be foolish to quibble any further about the ownership. Judge Brucker, the gentleman who challenged Davis with reference to some of his statements, was the last echo of the old order of things. The judge was right when he said that Morgan was not prevented from selling if he could find a buyer and that in all probability it would not require a lantern to find a buyer. He was also right when he said that that would end Mr. Davis as an independent operator, but John is sure it will not mean the end of Davis as a telephone man. For in John's estimation that man Davis has got every man beat who has ever tackled the business end of exchange operating.

* * *

John also brought home the story that the Elson bill is a genuine old-fashioned Bell measure. To be sure it is a new method, but it reflects the old spirit of dog eat dog that has always been exercised by the opposition. I guess the independents will always have to look out for themselves. If there is ever to be any relief it will require more than an occasional speech from the officers of the National Association.

This reminds me, too, of John's report on Frank Wood's speech before the Columbus meeting. The president of the National Association is purely an old timer. He pulled the eagle's tail in great shape and hammered the old octopus for all he was worth. The applause all came at the end of his speech and if John caught the spirit of it, it was purely as a courtesy. He says there wasn't much soul in it and that sounds about like a proper expression. John says that Mr. Davis charged Mr. Woods with being a promotor for the Continental—which Woods promptly denied, but it seems that as a director in the Continental, Mr. Woods might be open to some suspicion. Possibly this is like the rest of the Continental operations—nothing clear—all so close that no one knows. If the ways of the A. T. & T. Company are clothed in mystery, they are an open book as compared to the Continental crowd.

* * *

I wonder if you appreciate that spring is here, that the fields are all plowed, that the buds are breaking on the trees, that the garden rake has bright prongs as a result of clearing up the yard, that the hens are setting, that we've already taken down the hams and wrapped them in vermin-proof cloth, that the garden is ready for general planting and that the hot bed is bursting with plants that want more air. It's great to get out into the sunlight again and feel the air without its winter chill. Business is good—especially the farm business. We got $9.25 for sixty-eight hogs and we are keeping the calves.

* * *

The local demand for telephones was never better. The activity made it possible for Obediah and Ben Phelps to put over their own little merger and by hustling among their own friends it wasn't very hard to dispose of their bonds. They haven't sold all of them, but they will go, if it is found that they are going to require all of that $50,000. If there is any truth that telephone securities should be owned locally, we have a fine example right in our midst. I have found that if you want a thing and want it with a whole heart, that it will come through all right. I know that the people of this section of the country wanted our systems consolidated and the owners wanted the same thing. When it was presented forcefully to these people, they co-operated as one man and everybody seems to be pleased.

* * *

The independents' keystone is confidence. Without it they will always encounter trouble. With it most of their trouble will vanish; when interests in a common cause begin to show symptoms of cold feet it is time to look for a landing place. If you are looking for a place to land, you will probably find it, sooner or later, and then there will be a better chance for those who remain to get ahead. The telephone business is fundamentally good. As a utility of public service there will always be opportunity for improvement and those who grasp the full possibilities will prosper. But the same broad methods must be exercised which have made other substantial enterprises. Confidence in your fellows will help the cause. Having read the full text of Mr. Davis' message to the Ohio operators, I am sure he is a strong business man and a leader. It is unfortunate that with such a man to head a large enterprise, sufficient local capital might not have saved the Ohio properties for the Ohio people. He showed how futile it was to have done this, and to what a large degree the effort was made.

* * *

I know of a case where a man started a business in a small way—one of those peculiar things that had a niche to fill in the world's progress, and it has grown in thirty years from practically nothing to a considerable affair now capitalized at $5,000,000. The business could not be duplicated for twice that sum. It has actual physical assets of two-thirds its capital. It pays ten per cent annual dividends on a million more than its capital. This same man finds himself tremendously rich. He has everything a man can have with money, except time to play. He is past sixty years and wants to sell his business—all of it, gun, stock and barrel; wants to sell it to somebody who can prove to him that it will be carried along as he has carried it. He owns all the stock. He could promote a $10,000,000 company—guarantee a six per cent annual dividend—keep a controlling or a minority holding—and trust to luck, but he simply wants to clean up. I am wondering if he will be regarded as foolish? In the light of some of the telephone people, judged by their acts, he is a doting old chump. In my opinion, he loves his business as a business more than the handsome revenues it returns in cold cash of the realm. When telephone men have a similar regard for their business, there will be no occasion to cry confidence.

* * *

In the meantime, does anybody know where there is enough loose change to buy up the business I have mentioned and which has been established upon coin and confidence, hard knocks and hard application? It is a beautiful property—a real case—not a fairy tale.

Experiments in Sound Reproduction

By Emil Kosack

SINCE Philipp Reis first exhibited his apparatus for the electrical transmission of sound, to which he gave the name telephone, nearly half a century has elapsed. By means of this apparatus, comprising transmitter and receiver, songs and instrumental music could be transmitted satisfactorily, but for the transmission of speech it required fundamental improvements, which were first developed chiefly in America and assumed practical form in the Bell telephone. This instrument consists of a steel bar magnet, bearing at one end a small coil of wire, and an iron membrane stretched closely above the coil-bearing pole. When the coil is traversed by an electric current of rapidly fluctuating intensity, corresponding variations in the strength of the magnet and its attraction for the iron membrane are produced, so that the membrane is set into vibrations which generate sound waves in the air, and produce audible tones.

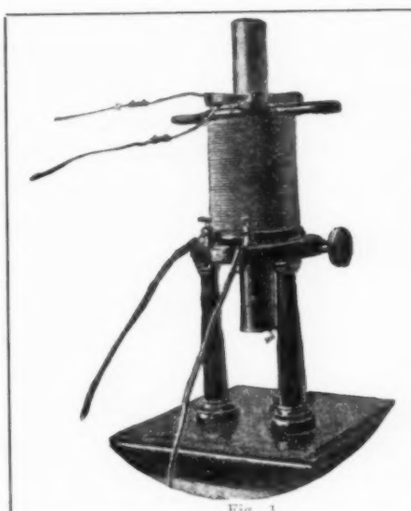


Fig. 1.

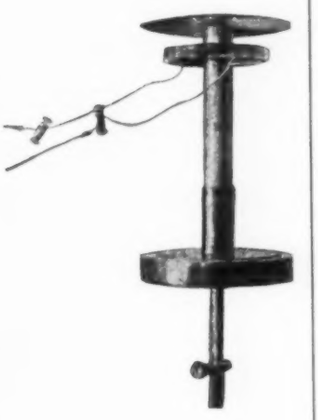


Fig. 2.

An important stage in the development of the telephone was marked by the invention of the microphone, which is now employed universally as a transmitter. Its essential part is an electrical connection of varying resistance, formed by the loose contact of pieces of carbon, inserted in the circuit of a few volts. The resistance of the contact and, consequently, the strength of the electric current vary with the force with which the carbon surfaces are pressed together, and this force is sufficiently affected by the fluctuations produced by speaking into the instrument to cause variations in the current, which correspond in every detail to the vibrations of the vocal sounds. Hence, if a Bell telephone is inserted in the same circuit, its membrane is forced to vibrate in a corresponding manner, and thus to reproduce the sounds spoken into the microphone.

The Bell telephone, in improved form, still remains almost the only practical telephonic receiver. Several other methods of translating the currents of the microphone into sound have been discovered, however. In 1898 Simon found that an electric arc lamp will reproduce words spoken into a microphone, if the vibratory microphone current is superimposed upon the uniform direct current which normally operates the lamp. This phenomenon is explained by the variations in the temperature of the arc, which are produced by the microphone current, and which are sufficient to cause vibrations in the surrounding air, which are perceived as sound. The microphone current is impressed upon the arc, not directly, but indirectly, by means of a small induction coil, or transformer, consisting of an iron core surrounded by two coils of insulated wire. One of these coils is inserted in the circuit of the microphone, the other in the circuit of the lamp. The fluctuating microphone current in the first coil generates, by induction, a similarly fluctuating current in the second coil, connected with the lamp.

With this apparatus several experimenters observed that the telephonic reproduction of sounds sometimes took place when no luminous arc was formed, and traced the sounds to the transformer. The writer discovered that even the hissing sound which is occasionally produced by arc lamps was clearly audible in the transformer, placed in another room. As a transformer is essentially an electromagnet, it follows that every electromagnet and every permanent magnet can be made to sing and speak under the influence of a vibratory microphone current, which causes periodic changes in the magnetization of

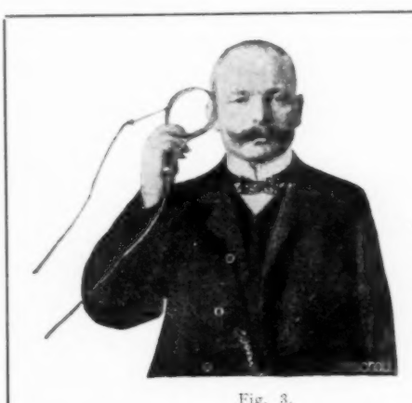


Fig. 3.

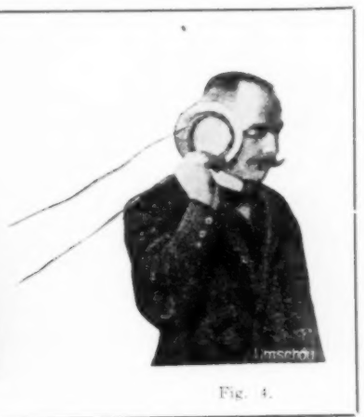


Fig. 4.

*Translated from *Umschau*.

the iron or steel and thus produces molecular vibrations which generate sound waves.

Peukert found that even the large masses of iron contained in dynamos can be thrown into audible vibration by the weak currents of the microphone, and constructed a telephonic receiver consisting merely of a closed horseshoe magnet, encircled at one point by a coil of wire connected with the microphone. The form of "speaking magnet" used in the writer's experiments is shown in Fig. 1. It is a straight bar electromagnet, energized by a direct current, but carrying also a small coil connected with a microphone. The writer found, furthermore, that the magnet could be replaced by a simple core of ordinary unmagnetized iron. This change greatly weakens the action which, however, is greatly intensified by laying a thin plate of any material on the upper end of the core, as shown in Fig. 2. The plate takes part in the vibration and enables a roomful of persons to hear music played or sung before the microphone at the other end of the line. In this experiment the entire absence of the disagreeable crackling noises produced by the ordinary telephone was especially striking. This form of apparatus shows a certain resemblance to the old Reis telephone, in which, however, the iron is not in the form of a heavy bar, but in that of a thin wire, which is attached to a resonance chamber.

From all these experiments it appears that a telephonic receiver can be constructed in the most primitive manner by inserting almost any coil of wire in the microphone circuit, slipping the coil over a hammer or other piece of iron, and attaching a plate of any material to the iron. Hence the iron membrane or vibrating plate of the Bell telephone is entirely superfluous. The writer has found by experiment that the construction can be still further simplified to a surprising degree. It is only necessary to apply to the ear a coil of wire connected with the microphone in order to hear faintly the sounds by which the microphone is operated (Fig. 3). Such a coil, consisting of a few yards of insulated copper or iron wire, is certainly the simplest form of telephonic receiver, but to give the instrument any practical value it is necessary to attach to the coil a plate of iron, brass or other metal, as is shown in Fig. 4. The metal plate intensifies the sound so greatly that when the instrument is applied to the ear words softly whispered into the microphone are distinctly audible. This apparatus differs from all forms of telephonic receiver now in use by the peculiarity that no iron need be used in its construction.

The action of this new telephonic receiver is explained by the well-known law of attraction between two parallel conductors traversed by electric currents flowing in the same direction. The individual windings of a coil of wire may be regarded as so many parallel conductors, which attract each other with a force which depends upon the strength of the microphone current which flows through them. As the fluctuations of this current correspond to the vibrations of the sound waves which act on the microphone, entirely similar vibrations are produced in the wire coil of the receiver and transmitted to the surrounding air, as sound waves, through the agency of the plate.

Chicago Independent Gets Start

By the terms of a contract approved March 16 by Judge Christian C. Kohlsaat, of the United States circuit court, Chicago will have a new independent telephone system in working order by June 1, 1911.

The contract is between the receivers of the Illinois Tunnel Company, David R. Forgan and Charles G. Dawes, and Joseph Harris, president of the Automatic Electric Company, for the installation of an independent automatic system for the tunnel company to comply with the requirements of the tunnel corporation's franchise with the city.

The financing of the new system's installation will be accomplished by the issue of receiver's certificates authorized some time ago by Judge Kohlsaat. An issue of $3,500,000 of these certificates was authorized by the court and of this amount $3,000,000 already have been issued and disposed of. The issue was placed with Surto Bros. & Co., a New York brokerage firm.

The certificates run for two years, bear interest at six per cent, and will be made lien upon all the property of the company and its net earnings and income.

The lien will come before the judgment recovered by the Corporation Trust Company against the tunnel company and also before the first mortgage, made by the Illinois Trust Company to the Equitable Trust Company as trustee, and all other bonds issued under first mortgage or deeds of trust.

The contract between the receivers and the Automatic Electric Company provides in substance that Mr. Harris have completed and in operation by June 1 of next year 20,000 main line telephones serving 20,000 bona fide subscribers within the limits of the city.

It means more than this, however, in view of the fact that as soon as the first installation is completed connections will be made with a comprehensive long distance system giving connections to Chicago business houses with more than 1,250,000 independent telephones within 500 miles of the city.

These embrace, according to Mr. Harris, fully one-half of all the business telephones of both independent and Bell lines within the territory covered.

"We shall put in a complete new automatic telephone plant of the latest and most approved type of apparatus manufactured by our company," said Mr. Harris. "As many more than 20,000 required by June 1, next year, will be put in operation thereafter as are required by the public.

"The apparatus to be furnished will be of the type which is now in service in approximately 100 cities and towns in the United States as well as in Canada, and the same type is being installed in Havana, Cuba, and Honolulu.

"A large volume of business has heretofore been diverted from Chicago to Minneapolis, St. Paul, St. Louis, Kansas City, Indianapolis, Toledo, Cleveland, Columbus, and Buffalo, and elsewhere where independent plants are in existence with these toll line connections.

"This territory is naturally tributary to Chicago and the business will come here when the new arrangements are completed. The contracts having been signed, the work of constructing the new system will be commenced without delay."

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

IT IS refreshing, even in these spring fever days, when shirt waists are getting thinner and the boys are out in the back lot throwing their arms out of socket, to get hold of a baseball fan. We have one here. On this page you may gaze unhindered upon the placid features of a man who knows more about the third sack on a ball diamond than a dozen Steinfeldts will ever find out. The third base of any ball field is consecrated ground after Charles Sumner Winston gambols over, on and about it. And he claims to be an amateur. That shows his modesty—the feature that predominates over the other qualifications that characterize the man. For Winston is no amateur in anything he has or will undertake. Baseball men who have seen Winston play know this. Walter Camp, of Yale, while particularly brilliant with football, also knows something about baseball, and after seeing Winston play the position northwest of the home plate declared it had dignity when a dignified player was on the job. It is said that Caspar Whitney made a garland of dandelions and placed it on Winston's prematurely bald head and told him to forget his amateur bombast, and Stagg himself never quite revived after Winston left his team.

And He Claims to be an Amateur

So, then, here is the champion third baseman of this and several other countries.

It has been sometime since Charles Sumner Winston played the game, but that doesn't matter—he's champion of that favorite dying place even yet. He played third on the Chicago University nine from '93 to '98 and when he graduated, receiving the degree of A. B., everybody knew what it meant, for Winston was also a hitter—a "pinch hitter" they call it now—and his specialty was to put it across the fence, so no one would interfere with his easy lope around the path. And when he took his "At Bat" degree down to the University of Illinois to put some finishing touches on it in '97, they just naturally put him at work over on the third bag, where he added more laurels to his great fame as a cham-peen.

Here is something else that you ought to know about Charles Winston. He never went to public school, nor kindergarten, nor anything like that. Gracious, isn't that awful! Playing on university ball teams and never a thing to show that he'd ever attended places of instruction—pretending all the while to be an amateur! It is time to be straightened out, because the going is getting hard. Here is how. Charles Sumner Winston was born in Forreston, Illinois, September 18, 1896. He was one of those particularly fortunate babies who fell into the hands of a good mother who knew. She kept her hands and her mind on the good babe. She never let go. All through baby days and childhood days to the days when there was in her care a fine type of young man, she was equal to the charge. Her's was the master mind who fitted the son for his step into college, and at nineteen he was admitted to Chicago University, fully qualified to work with his class. As it has already been hinted, Winston finished the big Standard Oil institution in 1896 as bachelor of arts. That bachelor business had a bad influence, for he's still a bachelor. After he had been done four years in oil, he spent a college year between Urbana and Champaign in electrical engineering.

It was during the spring and summer of 1897, however, that he got into the telephone business, and this probably influenced his final college year's work; for when he left the University of Illinois in 1898 he engaged with the Western Electric Company, Chicago, and for two months worked in the switchboard assembling department, after which he was transferred to the installing department. He assisted in the installation of both the Central and Harrison exchanges of the Chicago Telephone Company, and upon completion of the work returned to the engineering department of the Western Electric Company, where he remained until April, 1901. That was the time when Mr. Winston left the manufacturing end of the Bell company to enter the employ of the Kellogg Switchboard and Supply Company. He was connected with the engineering department of the plant continuously until January 1, 1904, when the company turned the department over to him, with the title of chief engineer. It is a fitting title for a man who is fit.

Mr. Winston has contributed his skill to a line of apparatus with a world-wide reputation for its goodness. The Kellogg line was highly efficient before Winston came on the scene, but it has been improved since he has been the company's chief engineer. His achievement in this serious work has proven

that Whitney and Camp and Stagg knew what they were talking about when they said Winston wasn't an amateur. The chief engineer of the Kellogg company has thirty or more inventions to his credit. He modestly refrains from saying which of these have the greatest significance as pertaining to telephony—the art. They are Winston patents. Obviously they are good, first because they came from Winston, and second because they came out of a house noted for things telephonically good.

Winston has time to devote to the Quadrangle Club, Chicago. He is associate member of the American Institute of Electrical Engineers.

New York Commission Control Bill

State control and supervision of telegraph and telephone companies by the New York state public service commission, second district, is recommended in a report submitted to the legislature March 21 by the special committee appointed last year to investigate the subject.

The committee believes that the commission should have power to regulate rates and service, the merger of telephone and telegraph corporations and properties within this state, and the issue of capital stock securities, the proceeds from the sale of which are to be used in extensions or betterments to property situated in this state.

Frank W. Stevens, for years attorney for the Vanderbilts and Morgans, will, as chairman of the upstate public service commission, be the grand overseer of telephone and telegraph corporations if the legislation recommended by the Davis-Merritt commission becomes operative.

Census Report on Operators

Conditions existing in telephone exchanges throughout the country are set forth in the report recently sent to the Senate dealing with the investigation made by the Bureau of Labor. The bulk of the report deals with the women employes—there are 17,210 of them working at the switchboards for twenty-seven companies in twenty-six states which furnished the data.

Agents of the bureau visited seventy-three exchanges and found them, generally speaking, well housed. In many cases the girls were compelled to walk up from one to four flights of stairs, and more than two-thirds of the complaints heard were because of the lack of elevators.

In some cities medical or physical examinations are required of applicants. The height is often determined without the applicant's knowledge by a young woman who engages the former in conversation while she compares the level of the other's eyes with her own. The educational requirements are usually that the applicant must have passed the sixth or seventh grade in grammar school.

Wages for telephone girls vary from a highest monthly average of $36.96 in New York City to $22.40 in Nashville, Tenn. In some of the smaller cities the average goes even lower, particularly in the south. The Bell Company employs 16,256 women operators at an average monthly wage of $30.91.

In nearly all offices the operating force is divided into four general shifts. Day operators usually work between 6 a. m. and 7:30 p. m.; night operators usually work beyond midnight.

Efficient service is possible up to 225 calls an hour for each girl. She cannot answer more than that without injury to herself or injuring the service. The bureau has reached the conclusion that the operator who has not enough to do to keep her constantly busy, however, does not properly attend to what she has.

Commissioner Neill strongly urges the practical elimination of overtime for operators and says this can be brought about if the larger cities will set the example. New York City has done so, but in Chicago the Bell operators have about 28 per cent of overtime, and in New Orleans as high as 98 per cent.

A widespread and intelligent effort on the part of the companies to look after the comfort and well being of its women employees was found. On the other hand, the investigators discovered that the women were loyal to the companies and enthusiastic for their work.

Pittsburg A. I. E. E. Discusses Power Boards

The Pittsburg section of the American Institute of Electrical Engineers held its regular meeting at the Carnegie Institute, March 8, 1910. B. P. Rowe of the Westinghouse Electric and Manufacturing Company presented "Some Practical Hints for Securing a Satisfactory [power] Switchboard."

Mr. Rowe discussed the question from the purchaser's standpoint, showing that the question of what apparatus is needed and its type is the first consideration and after that its arrangement and assembly should follow. He spoke in favor of keeping as much apparatus off the back of the switchboard as possible.

H. L. Fullerton and H. N. Mueller of the Allegheny County Light Company offered some points from their own experience and J. S. Jenks of the West Penn Railways Company referred to the difficulty of building an ideal switchboard in an old structure. One of the particular points of discussion was distant control by bell crank and by transmission rope.

S. Q. Hayes of the Westinghouse Electric and Manufacturing Company elaborated at some length on some of the points brought out in the paper.

Pennsylvania Companies Appeal

The Consolidated Telephone Companies of Pennsylvania, a branch of the independent system, has asked the State Railroad Commission to review its decision in the recently heard case of the Consolidated against the Bell Telephone Company of Pennsylvania and the Slate Belt Telephone Company, operating in northeastern Pennsylvania.

The company gave ten assignments of error, contending that in directing the elimination of the exclusive connection contract clause the commission corrected only a part of the matters complained of, and that the contract still in force is in restraint of trade and injurious to competition by the Consolidated.

Music by Wireless

Wireless telephony was recently tested to show its value as a transmitter of music, at which time a number of selections were sung into a transmitter at Park avenue and Fortieth street and were received at the Metropolitan tower with varied degree of distinctness, at times being very clear and again nothing but a confused blur being perceptible.

A. T. & T. Company's Annual Report*

BELL SYSTEM IN THE UNITED STATES.

SUBSCRIBER STATIONS.—At the end of the year the number of stations which constituted our system in the United States was 5,142,692, an increase of 778,063; 1,508,790 of these were operated by local, co-operative and rural independent companies or associations, having sub-license or connection contracts, so-called connecting companies.

Wire Mileage.—The total mileage of wire in use for exchange and toll service was 10,480,026 miles, of which 649,308 were added during the year. These figures do not include the mileage of wire operated by connecting companies.

Traffic.—Including the traffic over the long-distance lines, but not including connecting companies, the daily average of toll connections was about 517,000, and of exchange connections was about 19,925,000, as against corresponding figures in 1908 of 463,000 and 18,500,000; the total daily average for 1909 reaching 20,442,000, or at the rate of about 6,582,300,000 per year.

Plant Additions.—The amount added to plant and real estate by all the companies, excluding connecting companies, constituting our system in the United States during the year 1909 was:

For exchanges	$20,958,700
For toll lines	6,316,100
For land and buildings	1,425,300
	$28,700,100

Plant Additions of Previous Years.—The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500; in 1903, $35,368,700; in 1904, $33,436,700; in 1905, $50,780,900; in 1906, $79,366,900; in 1907, $52,921,400; and in 1908, $26,637,200, making the total expenditure for additions to plant during the ten years $407,172,900.

Maintenance and Reconstruction.—During the year $44,838,900 was applied out of revenue to maintenance and reconstruction purposes.

The total expenditure for maintenance and reconstruction charged against revenue for the last seven years was over $231,500,000.

Our charges against revenue for maintenance and reconstruction are no more than a conservative policy would dictate. It is necessary to make suitable provision for any change of plant and equipment required by the evolution and development of the business.

In the meantime the public is getting the benefit of the surplus and reserves without cost to it.

Permanency of Plant.—All that was said last year about the permanency of the plant could be re-said and emphasized this year. Steady improvement is being made in both plant and apparatus, but as the lines on which it is based are of a permanent character the process is one of evolution, not revolution. Careful comparative studies seem to warrant the statement that there is no one of the larger public service corporations that has a greater ratio of plant value to its outstanding obligations than has this company, nor has the plant of any other such company as great a ratio of realizable value to the book valuation.

Real estate, underground conduits, copper wire, cables of lead and copper, rights of way on private property—which represent such a large proportion of the company's assets—have a permanent value in the business and even a realizable value outside of the business which would be no mean asset.

Construction for the Current Year.—Estimates of all the associated operating companies and of the American Telephone and Telegraph Company for all anticipated requirements for 1910 have been prepared. Maximum expenditure in each case has been agreed upon, and all who are responsible for the expenditures are working in entire accord with these agreements and understandings, and it is believed that the results will be, as they were in 1909, well within the limits fixed.

ASSOCIATED OPERATING COMPANIES.

Financial Condition.—The associated operating companies (not including the American Telephone and Telegraph Company) show for the year, as compared with last year, an increase in gross of about $10,000,000; operating expenses and taxes increased $2,484,000. (Total taxes paid $6,316,000.) Charges to maintenance out of earnings increased $5,214,000. Interest charges were $80,000 more. The balance available for dividends was $30,899,000—$2,217,000 more. Dividends to the amount of $22,610,000 were paid, an increase of $1,004,000.

The undivided profits were $8,289,000, an increase of $1,212,000.

ENTIRE BELL SYSTEM IN UNITED STATES.

The gross revenue collected from the public for telephone service by the Bell system—not including the connected independent companies—was $150,000,000; increase of nearly $12,000,000 over last year. Of this, operation consumed $50,000,000; taxes, $7,000,000; current repairs and maintenance of property and provision for depreciation $45,000,000.

The surplus available for charges, etc., was $48,400,000, of which $10,220,000 was paid in interest and $24,000,000 paid out in dividends to the public.

The capital stock, funded and floating debts outstanding in the hands of the public at the close of the year were $581,300,000. The surplus of liquid assets was $57,200,000, leaving $524,000,000 as the net obligations of all the system to the public.

Against these obligations, the companies had property $612,600,000—an excess of $88,600,000, or 17 per cent.

In addition, there is the intangible property, such as licenses, contracts, patents, rights of way, etc.—not including any public franchises—of great value, which it would now be difficult to obtain at any price.

In every case where the public authorities have appraised the plant of the companies, the valuation has been far in excess of the book valuation. It is within the bounds of conservatism to say that the obligations of all the companies outstanding in the hands of the public are represented by 150 per cent of property at a fair replacement valuation of the plants and assets, not including public franchises.

Increase of Capital Stock.—The limit of the authorized capital with what is reserved against the conversion of the convertible bonds has almost been reached. The expansion of our business is continuous and probably will continue at least as fast as in the past. It is believed, however, that in the future much of the financing can be done locally, thus relieving this company of the burden and strengthening the local associate company.

While there are not in contemplation any large financial operations, yet a company of this magnitude should be in a position where every situation can be met promptly and effectively; it is recommended that the authorized share capital of this company be increased from $300,000,000 to $500,000,000.

None of this increase will be needed during the current year for ordinary capital expenditures.

Independent and Opposition Companies.—A large number of opposition and independent companies have been absorbed into the Bell system during the year. Our position has been consistent. Wherever any opposition company can be legally brought into and made a part of the Bell system, it is done if it can be done to the advantage of the public, by and with the assent of all parties interested, including not only the public served, but the public authorities.

Rearrangement of Territory.—Some effort has been, and is being, made to make a closer adjustment of the boundaries of our associated companies to the commercial or geographical boundaries.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

The improvement which has marked previous years still continues. The net revenue for the year was $30,190,765.86, out of which were paid interest $7,095,377.34, and dividends $17,036,275.64. The balance, $6,059,112.88, shows an increase notwithstanding the large increase in dividends due to the exchange of convertible bonds for shares.

Convertible Bonds.—At the close of business December 31, 1909, $101,861,000 of the $150,000,000 convertible bonds sold had been handed in for conversion, leaving outstanding at that date $48,139,000.

Share Capital.—Due to the conversion of the bonds, and the sale of the shares of the company which were in the treasury, there has been an increase of $97,998,700 in the outstanding share capital. This increase has been well distributed. The number of shareholders, 35,823 on December 31, 1909, shows an increase of 9,453 during the year. The distribution is general, there being 35,510 shareholders out of the 35,823 holding in blocks of less than 1,000 shares each, 1,700,543 shares—an average of 47 shares each. The distribution continues, as the number of shareholders

*Abstracted.

has increased 1,500 during the first two months of the present year.

This has been completed during the past year in the Middle States by bringing together into the New York Telephone Company and the Bell Telephone Company of Pennsylvania the territory naturally belonging to each. In both cases this was accomplished by a virtual consolidation of the various companies operating in the territory, and in both cases the outstanding obligations after the consolidation showed a considerable reduction below the total outstanding obligations of the various companies combined.

AVERAGES OF OPERATING UNITS—ASSOCIATED COMPANIES.

Taking the years 1895 and 1909, the average exchange revenue per station of the associated operating companies for exchange service was reduced from $70 to $31.50, or 55 per cent; the total revenue including toll revenue per exchange station reduced from $81 to $41, or one-half; the operating expenses including taxes reduced from $31.50 to $17.10, or 45 per cent; maintenance per station reduced from $26.20 to $13, or one-half. Total operating expenses were reduced from $57.70 to $30 per station, or not quite one-half—that is, reduction of operating expenses of about one-half brought about a reduction in cost to the public exchange service of over one-half.

The average plant cost, including toll and exchange construction, was reduced from $260 to $145 per exchange station, about 45 per cent. All plant costs show a decrease per unit, although there has been an increase in both labor and material.

WESTERN UNION TELEGRAPH COMPANY.

In taking over a substantial interest in the Western Union Telegraph Company, this company assumed a substantial obligation to the public in addition to that which it already had. To make clear the extent of this obligation and the resulting advantages, and to illustrate the various shades of relation between the telegraph and the telephone, some explanations will be interesting and instructive.

The connection or relation between the telephone and the telegraph is not in any sense one of substitution, it is supplementary; one is auxiliary to the other.

Telegraphy eliminates the time of transit of correspondence, by the electrical transmission of the text from office of origin to office of destination, but it is incomplete in that the methods of collection and delivery are slow and primitive.

Telephony eliminates distance by placing parties at distant points in direct personal communication with each other, but the expense prohibits its use for the transmission of written messages over long distances.

Telegraph operation as carried on must have a separate, distinct and entirely different operating organization and equipment from that of a telephone company.

Line construction and maintenance are common to both the telephone and the telegraph, and can be combined or performed jointly with economy. The same wires may be used for both telephone and telegraph circuits and at the same time. The differentiation between telephone and telegraph construction and operation begins with the stringing of the wires.

Where there is density of message traffic sufficient to keep busy an expert telegraph operator, the telephone cannot be used in competition with the telegraph in the handling of message traffic, but at some point of less density of traffic the telephone will gradually supersede the telegraph in handling message traffic.

The elementary differences in the scope and operation of the telephone and the telegraph in the handling of telegraph traffic indicate that each will occupy a distinct and a well-defined field.

The telegraph between centers of density and for long distances.

The telephone for short distances and for the collection and distribution between the customer and such centers.

About 65 to 70 per cent of the telegraph traffic is between, that is, both originates and ends in, about 550 cities and towns of 10,000 or more population. The Western Union telegraph lines reach over 22,000 smaller cities and towns and villages, at most of which the commercial telegraph traffic would not of itself support a telegraph office. This business is now being performed necessarily under some joint arrangement, for the greater part with the railroad companies. While these arrangements will be continued, a greatly extended and improved service will be given in connection with the Bell system with over 5,000,000 stations located in 50,000 cities and towns, most of which will be put in immediate connection with telegraph offices at central points. In this way the electrical transmission of messages will be extended from the actual point of origin to the actual point of destination.

There are comparatively few places where there is business enough to warrant a "night and day" telegraph service, but there is no place where "night and day" telegraph service is maintained that is not in the center of a "Bell system." Practically no Bell exchange is ever closed—therefore there are few subscribers of the Bell system who cannot be placed within reach of night and day telegraph service.

Under the new conditions, when in full operation, each service, the telephone and the telegraph, will find its level of use, its field of best usefulness, with a distinct improvement in, and advantage to, both services.

Such economies as follow will be taken advantage of to increase the facilities and where possible reduce the cost to the public.

Before any change can be made in the existing rates for existing service, it will be necessary to await the result of studies now being made, as it is claimed that the irreducible cost of handling is so near the revenue received for each commercial message that no reduction in rates would be justified by any probable increase in business.

Improvement and extension of existing service and introduction of new classes of service will be the first effort of all interested. The first of these will be the introduction of the "Night Letter," and others will follow.

The benefits and advantages from this complementary operation will come, but not all at once. Careful study and consideration are being given to all questions by all interested. Existing plant will have to be rearranged or reconstructed, new plant constructed on proper lines. The necessary safeguards for the protection of the company and the public will have to be worked out.

The idea of operating the telephone and the telegraph in accord, each supplementing the other, is not a new or untried one, but has been ineffective because of the lack of common influence in the control of the operations. With the employes of both companies actuated by a common purpose, this can be effectively done; without a common influence in the operation it has been practically impossible.

The Eskimo and the Telephone

Prof. D. B. McMillan, of the Peary North Pole Expedition, relates an amusing story regarding the efforts of an Eskimo to construct a telephone line. The Eskimo came into possession of a piece of wire and never having seen wire before he asked Professor McMillan what it was and what it was for. He was told that the white man strung it on poles stuck in the ground and by talking to an instrument at one end the voice could be heard at the other end. After some search the next morning, the Eskimo was found to be engaged in telephone construction work of his own. He stuck some sticks in the ground and hung his wire on them. He held one end of the wire to his mouth and talked to it at the top of his voice. Then he ran as fast as he could to the other end and held the wire to his ear expecting to hear his own words repeated. When he failed to hear any sounds the expression on his face revealed his opinion of his white friend.

Fire and Police Calls in Chicago

Under its franchise, the Chicago Telephone Company makes no charge for giving connection with "Main 13," which is the one by which the company gives connection from any of its telephones in the city to the nearest police station. These calls for 1909 exceeded those of previous years by 12,602. "Main 13" does not represent a particular telephone, but is a designation used to identify the instrument at the police station located in the territory of the exchange, with which the subscriber is connected. "Main O" connects the subscriber with the fire alarm telegraph office, and is to be used only in cases of fire. The calls on this telephone in 1909 exceeded those of 1908 by 986. During the year 1909 the company transmitted 8,825 free fire calls and 62,005 free police calls.

Some Romances of the Telephone

By J. Rodney Bates

Illustrations by O. H. Brandenberg.

TRAGEDY, comedy, farce, tears, laughter, love messages—every expression of human emotions flows daily and nightly over the telephone system of Chicago. The operator who sits at this great ear of two million people hears many strange and oftentimes terrible things. While the rule of secrecy as to names is maintained, some queer things are told my the telephone officials, a few of which are related here.

It was about midnight a few years ago when a general fire alarm rang through the city and the fire engines dashed wildly through the streets to the rescue of a great factory building that was blazing in the loop district. The building was doomed, for the alarm had come too late. The night watchman, the only living soul in the place, was caged in an upper room. The flames roared angrily all about him, cutting off every available means of escape and rendering the desperate efforts of the firemen futile to effect a rescue.

A telephone operator seated at the central switch board was called and heard a terrible voice at the other end of the wire call frantically for a number. It was the doomed watchman, who, realizing that death was inevitable, was calling up his wife to bid her farewell. The wife was given the wire but the details of that incredible conversation never will be known. For a few moments the wife listened to the voice of her husband and then his fate overtook him. There was one last cry and a terrible crash. The floor had fallen and the flames had seized their victim.

Calling His Wife to Bid Her Farewell.

Another tragedy of the telephone occurred two years ago on South State street. A man who had been jilted by his sweetheart entered a saloon near her house and drank himself into a state of frenzy. Knowing that the telephone in her house was close to the first floor window, he rang up the woman from the saloon and in a disguised voice asked her to hold the wire for a moment, as there was someone who wished to speak to her. Dropping her receiver, he run round to the house and, through the window, shot the waiting woman dead.

This tragedy is excelled in horror by the tale which is told of an operator in a little Illinois town who, through some means which never have been ascertained, found her exchange connected one night with a telephone in a lonely farmhouse about twelve miles out of the town, and was the impotent auditor to an awful drama.

The Bridegroom at the Other End of the Wire.

She heard a sound of muffled cries and several revolver shots fired inquick succession. Then all was silent. The alarmed operator, knowing the solitary situation of the farmhouse, at once notified the authorities. The sheriff with a posse rode out to the place, but could not get admittance. The house was dark and silent and, fearing they knew not what, the officers of the law broke down the door and entered.

The first thing they encountered was the body of the farmer, his throat cut and a razor clasped in his hand. He was long past human aid, and the officers proceeded to investigate the other rooms. In an upper bedroom they discovered the bodies of the farmer's wife and his two children. They had all been shot dead.

No explanation ever was given or ever can be given of this fourfold crime. That the farmer in a homicidal frenzy had first slaughtered his family and then taken his own life seemed a foregone conclusion, but there was no living witness to tell of what led up to the tragedy, and days might have elapsed before the discovery if it had not been for the strange message of the tele-

An apparent tragedy which, however, in its outcome proved simply humorous, occurred recently in Chicago. An operator was startled one night by a moaning sound which came over the wire from a warehouse on South Water street, which she knew was untenanted at night. The moans were heard by several of the other operators and it was determined to summon the police.

A patrol wagon dashed to the building indicated, but

everything was found dark and quiet. However, a detective, dispatched to the telephone exchange, also heard the moaning sound, and it was decided to force an entrance into the warehouse. Down in the basement the cause of the alarm was discovered. It was a half-starved dog. The wretched animal, wandering about in search of something to eat, had dragged the telephone off the desk and caused the moaning noise through gnawing the wires.

A bank clerk, working over hours, had occasion to transact some business in the bank vault. While there the door, through some accident, closed on him. It locked automatically, and he found himself a prisoner in an airtight room from which no cry for help could issue, even if there had been anyone near to hear it. It was only a question of a short time before the air in the vault became exhausted and the clerk would die from suffocation. Fortunately for him there was a branch phone in the vault. He got in communication with the bank officials, who reached the bank in time to save him.

The Cause of the Alarm Was Discovered.

Another story told of the beneficent use of the telephone was in a case where a fire started in a vacant room on the fourth floor of an office building. The occupants of the house acress the street noticed the flames and over the telephone aroused the inmates of the upper portion of the burning building, who were asleep. If it had not been for the possibility of telephonic communication the sleepers might not have been awakened before the flames beneath them had cut off their means of escape.

Sad are the stories told of the uses of the telephone at the Isolation hospital. Patients dying of malignant diseases, cut off by the nature of their disease from friends and family, are still able at least to hear the voices of their loved ones and convey to them their last mournful messages and wishes.

But all the tales of the telephone are not sad or tragic. It plays an important part in the business conducted by Cupid. Of course, love messages flash across the wires in hundreds every day, but there also are stories told of where the actual marriage ceremony has been performed by telephone. Two lovers living in different towns are impatient to be joined in wedlock. There are reasons which prevent either going to the other. Fifty years ago the situation would be hopeless, but today comes the telephone to the rescue. The bride at one end of the wire, vouched for by reputable witnesses, and the bridegroom at the other end in a similar position. The clergyman receives the answers from either end and then to each in turn repeats the words which bind them together for weal or woe. It hardly sounds a satisfactory method, or one which would appeal to the average bride, but its novelty may compensate for its deficiency in romance.

To come to a still lighter side of telephony. There was once a Chicago subscriber who complained to the company that he was being annoyed by being called to the telephone and then informed that a mistake had been made in the number. He declared that it occurred far too often to be accidental. An investigation was made and it was discovered that Cupid was in fault again.

A certain young man had become smitten with the charms of the subscriber's stenographer. Whenever he had a spare moment he used to ring her up and murmur a few soft nothings over the wire. If the girl was busy, however, her employer was accustomed to answer the call, whereupon the enamored swain would at once say it was a mistake and hang up his receiver. It is hardly necessary to add that poor Cupid got a black eye again.

A woman called up her husband and was told by the operator that the line was busy. With the utmost indignation the woman announced that her husband never was too busy to talk to her, and when she subsequently got into communication with her spouse she demanded that he immediately see that that impertinent telephone girl be discharged.

President Gets Many Calls

Two hundred and six telephones calls for President Taft at the La Salle hotel, Chicago, during his stay there were answered by Information Clerk George Smith, the calls ranging from a desire to "Speak to Mr. Taft" to a demand that "My compliments be given the president, for I knew him in Ohio."

"The calls could not be delivered, of course," Clerk Smith said, "and I had to pacify the callers the best I could. When I told them the president could not answer it made them angry, and when I said 'Yes, this is Mr. Taft,' their joy was evident in their voices.

"It was a great strain, and 206 calls for one man in one day and evening, I believe, is a record—certainly here."

Chicago's Telephone Revenue

The City of Chicago recently received a check for $132,698 from the Chicago Telephone Company, which represents three per cent of the gross receipts of that corporation for the last six months in 1909. The total receipts for that period were $4,423,298, which shows that Chicagoans pay nearly $9,000,000 a year for the service. The toll earnings in the six months were $314,286, the exchange earnings $3,878,379 and the private line earnings $6,208.

Dry Cells and Their Characteristics

By Prof. Charles F. Burgess and Carl Hambuecher*

THE desirable characteristics of a dry cell naturally depend upon the service with which it is to be associated. Dry cells are used in the telephone field, in ignition service, electric-bell and annunciator work, with telegraph and alarm circuits, electric clocks, phonographs, etc.

The primary requisites of a dry cell are its ability to live over a long period of time, a low internal resistance, minimum polarization and rapid recovery. It is impossible to point out which is the most important of these qualities, since the relative importance depends upon the character of service required. Among the minor characteristics which are sought to be attained in dry-cell construction are: Absence of the leakage of the liquid, minimum increase of resistance with low temperature, convenience for connecting into circuit, and the general appearance of the cell.

The factors which govern the above characteristics include these: Materials employed in construction, the proportions of materials, the chemical and physical qualities of these materials, methods of assembling.

In spite of the fact that 40,000,000 or thereabout represents the number of dry cells manufactured each year in this country, little scientific work has been done in the way of making a detailed study of the various individual factors which influence the quality of the cell, if we may judge by the meager publications. On the other hand, much scientific work has undoubtedly been done, if we may judge by the marked improvements which have been effected in the product. It appears that dry-cell manufacturers who are doing the larger part of this work do not feel inclined to discuss analytically dry-cell construction.

Perhaps 80 per cent of the dry cells made and used are of the so-called No. 6 size, being in cylindrical form, the zinc container 6 inches high and 2½ inches in diameter. As far as the cylindrical zinc container is concerned, there is striking uniformity in dimensions and construction, the principal difference being in the thickness of the zinc, which may be found to vary from No. 7 to No. 11 sheet zinc gage.

All cells employ a carbon rod for the cathode plate. In some forms of cells this rests on the bottom layer of paper, and in others it is raised ½ inch from the bottom. It extends up through a pitch seal, and a brass cap or brass screw attached to the top constitutes the positive terminal of the cell. Some of the carbons used are of smooth cylindrical shape, while others are corrugated or fluted to give greater contact surface to the filling material.

Another striking similarity in most of the dry cells is the list of materials which are introduced into the zinc container. Similarity then ceases, and we encounter variations in the quality of the materials, the proportions, and in the methods in which the materials are introduced into the container.

The following list and proportion of materials may be taken as fairly representing the filling mixture in well-known types of cells: 10 pounds of manganese dioxide; 10 pounds of carbon or graphite, or both; 2 pounds of sal ammoniac; 1 pound of zinc chloride. Sufficient water is added to give proper amount of electrolyte to the cell, and the most suitable quantity depends upon the dryness of original materials, fineness, quality of paper lining, etc.

While these are the essential elements, other materials are frequently added—such as starch or other forms of paste, to improve contact of electrolyte to zinc and promote distribution of action throughout the charge. Mercury is occasionally added to effect amalgamations and prolong life of the zinc.

With the materials as above listed and in the proportions named the resulting cells may be good or they may be practically worthless, depending upon various factors. It is generally believed that purity of materials is the pre-eminent requisite. Commercial conditions, however, prohibit the use of chemically pure materials. The customary specifications for manganese dioxide calls for a granulated or powdered material having about 85 per cent of MnO_2 and less than 1 per cent of iron. This is a specification which can readily be complied with, and by careful selection and concentration it is possible to get as high as 92 per cent.

Physical qualities, porosity and size of grains are likewise important. The amount of available MnO_2 differs according to the chemical test employed, and "available MnO_2" by test may not be the available MnO_2 under the conditions existing in the cell. In storage batteries PbO_2 is an active material only when in suitable contact or proximity to grid or framework of the positive plate; and MnO_2 in a dry cell is active to a degree, depending upon its contact with the conductive carbon constituting the negative electrode. It is evident that penetration into the interior of a piece of MnO_2 is necessary if the entire mass is to be active; and porosity seems, therefore, to be important.

The purpose of the manganese is to effect depolarization, and thereby to maintain the voltage of the cell during discharge. The qualities designated "minimum polarization" and "great recuperative power" are dependent largely upon the amount and availability of the MnO_2 employed.

Carbon in a powdered or granulated form is employed to give conductivity to the mass of MnO_2 and to furnish a large amount of cathode surface. Retort carbon, coke, petroleum coke and ground carbon rods and electrodes are the various grades of carbon commonly employed for this purpose, and much of the variation found in dry cells is due to varying qualities of this carbon. Graphite is another form of carbon extensively employed in dry cells, and the more recent improvement in dry cells is undoubtedly due largely to the liberal use of this highly conductive though more costly form of carbon.

Sal ammoniac of a very pure grade is generally employed, and in addition to purity, the physical qualities of dryness and freedom from lumps are requisite to ensure proper mixing with the carbon and manganese.

The zinc chloride is also required to be of high purity and to be free from iron.

Sheet zinc constitutes the anode and serves at the same time as a container. Purity is naturally of im-

*Paper read before the American Electrochemical Society.

portance. The purchaser does not have, however, a variety of grades of zinc to choose from.

This anode makes contact with the electrolyte in the form of paper saturated with solutions of zinc and ammonium chlorides. Ideal conditions call for a corrosion of zinc only in amount equivalent to the current delivered to the external circuit. Excess of corrosion above this amount is caused by local action, and one of the principal problems in dry-cell manufacture is to reduce such local action to a minimum.

Local action is caused to a small extent only by solder, although the latter is decidedly electronegative to the zinc, but it is composed of two metals, lead and tin, both of which have high "over-voltages," which almost entirely prevent current flowing to these metals at the expense of and under the e.m.f. set up by the zinc. Some experimental cells made from sheet zinc streaked with solder on the inner surfaces showed little if any abnormal deterioration due to local action even after standing for several months.

On the other hand, copper or iron, but especially copper (which may occasionally find its way from the brass terminals into the cell), when coming in contact with zinc will set up destructive local action.

It occasionally happens that some of the filling material, the manganese oxide and carbon, gets between the paper lining and the zinc. This naturally gives rise to damaging galvanic couples. Also inequalities in the zinc itself may cause certain differences in potential.

If we were to assume all inequalities of the zinc electrodes to be removed, we still have opportunities for local action due to inequalities in the electrode on the other side of the soaked paper. Non-uniformity in the mixture is detrimental. Some manufacturers place the carbon rod in direct contact with the saturated paper resting on the bottom of the cell, the mixture surrounding it. This must necessarily give rise to some difference of potential, and a measurement of this gave a value of 0.176 volt, in such direction that current tends to flow from the carbon through paper to zinc, thence through paper to the manganese mixture and back to the carbon. To prevent this source of local action is probably the reason for the majority of cells now being made with the mixture interposed between all portions of the carbon surface and the paper.

While the carbon rod is generally considered to be the cathode, the really active cathode surface must be considered to be of a more extended structure. The carbon rod is surrounded by a mass of material—carbon, graphite and manganese—possessing metallic conductivity even though moistened by electrolyte. It would, therefore, be more accurate to consider the active cathode surface as that portion of the mixture just within the paper. While this may be the main cathode surface, it is not exclusively so, and the active surface progresses inward as the action of the cell goes on.

The cathode is a compound one, consisting of an intimate mixture of conductive carbon and graphite in contact with manganese oxide, and the e.m.f. of the cell is the summation of the electrode potentials, 0.56 volt for the zinc (against Ostwald's standard electrode), and about 1 volt for the carbon-manganese oxide mixture, or a combined voltage of 1.56.

While the cell delivers current to the external circuit this voltage decreases, the rapidity depending upon the amount of current drawn. If it were not for the manganese dioxide the drop in the voltage would be very rapid, and the value of the cell is, therefore, dependent largely upon the active manganese oxide or depolarizer. This manganese oxide is consumed. As commonly stated, it is reduced to Mn_2O_3, and in undergoing this change it becomes inactive both as a depolarizer and as a conductor. It is probable that the MnO_2 possesses sufficient metallic conductivity to contribute something to the conductivity of the cell, and when changed to the lower oxide it loses this conductivity. It thus becomes inert and occupies valuable space. It is natural to assume that the MnO_2 in the outer portions near the paper is the first to become reduced, the action progressing inward to a certain depth, this depending upon various factors, such as the intimacy of contact between the carbon and MnO_2, the purity, fineness and porosity of the latter, etc.

If the MnO_2 possesses metalic conductivity and makes contact with conductive carbon and both are moistened with electrolyte, there is a possibility that a certain amount of chemical action occurs owing to the voltaic couple thus produced.

A typical dry cell gives from 10 amp-hours (when short-circuited and run down in one hour) to 30 amp-hours. The open-circuit voltage is 1.5 or 1.6. A fair figure for the effective voltage during useful life is 1 volt for a discharge rate of 30 amp-hours, so that a fair energy rating is 30 watt-hours. During life the resistance of the dry cell increases, partly due to drying out, but more so on account of other reasons, like the partial reduction of MnO_2. Another reason is the accumulation on the surface between the paper and the zinc of non-soluble impurities of the zinc and the various basic salts and double salts resulting from the electrolytic corrison.

When a cell is first made up, the paper is saturated with a solution of zinc and ammonium chlorides. More zinc chloride is added as a result of the corrosion of the zinc. The increasing concentration of the $ZnCl_2$ in the presence of the ammonium chloride gives just the conditions which are needed for the production of various double chlorides, some of which are much less soluble than the single chlorides.

These insoluble double chlorides occupy the pores and spaces in the paper, crowding out the electrolyte and increasing the resistance. If ammonia is liberated, it may react with the $ZnCl_2$ to form a precipitate of ZnOH, which likewise clogs the cell, unless sufficient ammonia be present to redissolve this precipitate. That this clogging action occurs at the paper and proceeds inward toward the carbon rod is evident, since in taking apart a run-down cell there is usually found a hard crust of $\frac{1}{8}$ in. or more in thickness just inside the paper.

It is no doubt true that improvement in dry-cell construction must come through reducing this accumulation of insoluble non-conductive material. It may be suggested that this precipitation due to double chlorides might be delayed by using only NH_4Cl in the electrolyte to begin with, and, in fact, a somewhat greater amp-hour output can be obtained in this way. But it involves the more serious disadvantage of shortening the life of the cell on open circuit. The presence of $ZnCl_2$ in the electrolyte decreases in marked degree the local action.

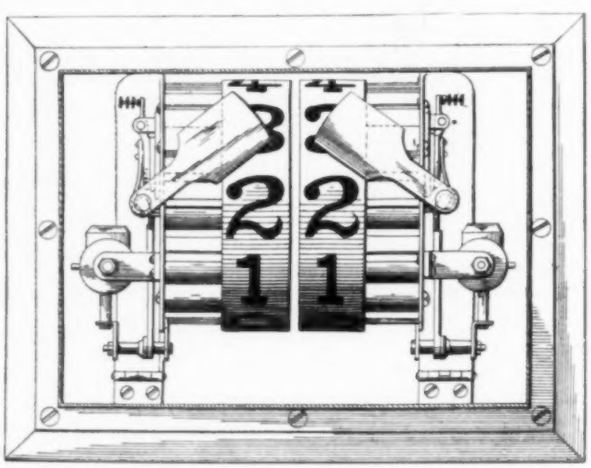
Although marked improvements have been realized, there is still need of and a possibility for improvements. A new method of rating dry cells by energy output should also be adopted. This can only be done after determining and generally adopting the standard methods for conducting tests.

Recent Telephone Patents

By David S. Hulfish

944,003. Signal System. A method and means for signaling a central office from a substation. There have been many efforts upon the part of inventors to simplify the means for calling a central office from a large number of substations in such manner that the central office attendant may be told the identity of the substation calling. Many of the improved systems invented have been devised directly for the telephone switchboard, while others are adapted for use upon such a switchboard if desired. The invention of this patent, is is stated, is adapted for telephone systems. The substations are subdivided into groups of one hundred, and the central office annunciator comprises in part two dial members bearing figures for tens and units. The act of calling from any substation sets the two dials to display the number of the station calling. Alfred L. Sohm, Los Angeles, Cal.

944,459. Testing Instrument. For locating breaks or grounds in a metallic circuit line. The instrument feeds current to the line through two coils which are arranged in magnetic opposition. When the coils are unbalanced in current because of the defective condition of the line, adjusting means are used having as a part thereof an indicator showing the position to effect a balance of the coils. The index shows at one reading the location of the fault. Matthew J. Myers, Syracuse, New York.



944,003

944,460. Selecting Apparatus. This patent has reference to apparatus for use on party lines, and private lines as well, on which a number of telephones are connected and on which it may be desired to hold a conversation between any two stations and at the same time to lock out the remaining stations from the use of the line circuit. The principal feature of novelty is found in the selecting device itself, and one of its chief mechanical novelties is the arrangement of parts which permits the pair of magnet spools to swing as a pendulum in effecting the operation on the ratcheting device which forms a part of each substation instrument. Charles E. Nicholas, Columbus, Ohio, assignor to Nicholas Telephone Selector Company of Rochester, New York.

944,537. Semi-Automatic. The system provides for answering a call with a plug and cord, then completing it by automatic switches controlled by the operator at the manual switchboard. The claims relate to the controlling keys for the operator. Albert M. Bullard, New York, N. Y., assignor to Western Electric Company, Chicago.

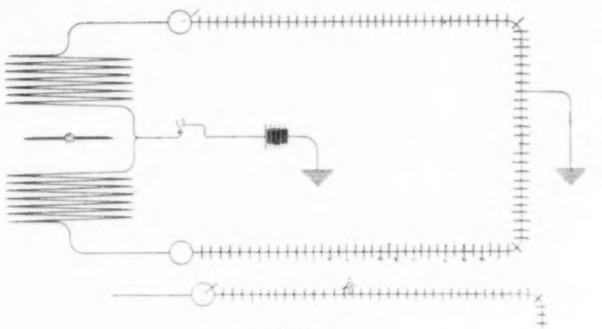
945,023. Transmitter. The front electrode is attached to the diaphragm by a screw of which one thread is cut in the diaphragm. Stanley A. Duvall, South Bend, Ind.

945,069 Multiple Transmitter. The transmitter has a funnel with the small end toward the speaker, the large end being filled with the many separate transmitters, all contained within a case. Frank W. Wood, Newport News, Va., assignor to C. and J. M. Cory, New York, N. Y.

945,429. Receiver. Watch case type. The permanent magnet forms the back but not sides of case, thereby being insulated from the diaphragm. Charles E. Williams, Boston, Massachusetts.

945,430. Transmitter. Portable, for audiphone purposes, and having a rheostat in the case. Charles E. Williams, Boston, Mass.

945,438. Paystation. A coin collector of audible signal type having provisions for detection of spurious coins. Francis X. Bee, Philadelphia, Pa.



944,459

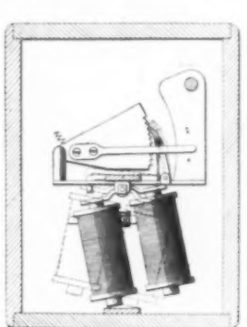
945,480. Telephone Set. A transmitter and watch case receiver are so conformed that the receiver attaches to the face of the transmitter when the set is not in use, the circuit switch being operated to break by the attaching of the receiver. Alfred L. Sohm, Whittier, Cal., assignor to National Electric Works, of same place.

946,258-9. Combined Burglar Alarm and Telephone Apparatus and System. James G. Nolen, Chicago, Ill., assignor to John E. Shepherd, of same place.

946,270. Attachment. A pair of ear pieces are connected by an acoustic tube, one of the earpieces being adapted also to attach to a telephone receiver; by this means the telephone user hears with both ears. Alcorn Rector, New York, N. Y., assignor to Rector Help-A-Phone Company, of same place.

946,287. Lock-Out Device. A selecting device for party-line substations. A main driving spring moves the selecting switch as permitted by an escapement controlled from the central office. An electric motor is shown for keeping the spring wound. Charles W. Throckmorton, Pittsburg, Pa.

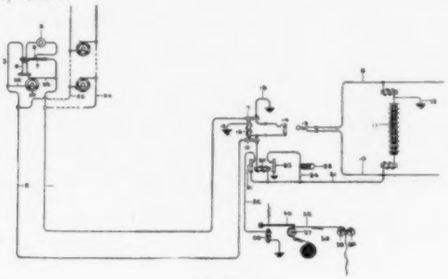
946,380-1-2. Meter. The registration of the use of the substation telephone is provided for upon the basis of measuring the total time during which the telephone is used for a conversation originating there. A motor at the substation is driven by the line current, revolving in different directons according as the call is sent or received; in one direction only it moves the dials of the meter. A relay in the cord pair provides also that the motor shall not move until the called line has answered. Ray H. Manson, Elyria, Ohio, assignor to Dean Electric Company, of same place.



944,460

946,410. Microtelephone. A receiver and common battery transmitter are mounted upon the two ends of a permanent magnet. The claims pertain to features of mechanical construction. Henry F. Thoma, Jr., and Clifford E. McGrew, Chicago, Ill.

946,489. Relay. A device of the "slow" or delayed-armature class. The solenoid core moves the armature contacts only at the end of its movement in either direction. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio.



947,320.

946,528. Common Battery Switchboard System. The cord pair of this switchboard has no relays, the circuits being such that the substation telephone bridge shunts out the supervisory lamp. The system is adapted for working with the ballast lamp devices of the Vote-Berger Company. Claude D. Enochs, La-Crosse, Wis., assignor to the Vote Berger Company, of same place.

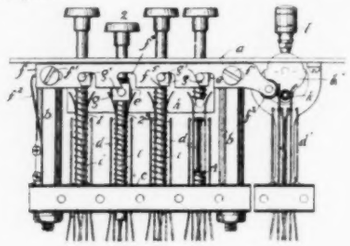
946,664. Attachment. A spring hammer is mounted upon the transmitter, by which means it may be shaken up when packed. Joseph P. Edwards, Chico, Cal.

946,839. Attachment. This disinfecting device for transmitter mouthpieces has means for holding the disinfectant, and for closing the mouthpiece. Joseph W. Dixon, Dallas, Texas.

946,725. Attachment. An antiseptic device for telephone transmitter mouthpieces. Martin Elzas, Los Angeles, Cal.

947,320. Recorder. In operating with measured rates upon party lines where the record is kept at the central office, it is desirable that some means be employed for indicating definitely the identity of the calling station of the line. The device here shown is such as to flash the line lamp in a distinctive manner for each of the stations. There is provided also a recorder for registering the calls. Charles S. Winston, Chicago, Illinois, assignor to Kellogg Switchboard and Supply Company, of same place.

947,335. Register. A substation device. A motor arm is set by the hook lever, and an escapement is so devised that registration is secured for a successful call but not for an unsuccessful one. David S. Hulfish, Chicago, Ill., assignor to McMeen & Miller, of same place.



947,722.

947,340. Switching Device. A switch set for intercommunicating and branch system, comprising particular means for holding the trunk line closed to hold the central office signal while a call is being switched over the automatic intercommunicating system. Stanislaw A. Koltonski, Boston, Mass., assignor to Electro Mechanical Works, of same place.

947,395. Transmitter. A damping spring engages the center of the diaphragm and has fingers pressing against the bridge, the damping spring carrying the resistance cell. William E. McCormick, Chicago, Ill., assignor to International Telephone Manufacturing Company, of same place.

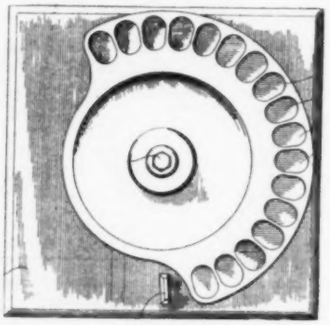
947,601. Connector. A device of the well-known McIntyre class, the improvement being found in the formation of the ends. Edward Schmidmer, Nuremburg, Germany, assignor of part to Bernhard Wilmsen, Philadelphia, Pa.

947,722. Ringing Key. A Multiple ringing key, of the type which rings four parties selectively, the buttons locking in partially depressed position to identify the key last depressed. The specific improvement is the locking means for identification. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company, of same place.

949,784. Armature. A specific arrangement of laminae and aligning devices for an armature for hand generator. Henry Tideman, Menominee, Mich.

949,797. Dial. An improved dial for automatic systems. Each of the finger holes has a movable bottom, and the stop of the dial is found in the movable bottom against the detent instead of the operator's finger against the detent, the accuracy of stop angle being thus improved. Daniel W. Kneisley, Dayton, Ohio, assignor to Dayton Telephone Lockout Manufacturing Company, of same place.

949,814. Attachment. In connection with a desk stand, a means for supporting the receiver in position for use. Robert Zinsmayer, Sandusky, Ohio, assignor of parts to Albert Krapp and Charles L. Blatz, of same place.



949,797.

949,821. Receiver. The device is specifically for "line direct" connection in common battery working, being provided with auxiliary coils to nullify the effect of the line current upon the receiver diaphragm. Claude D. Enochs, LaCrosse, Wis.

International Conference of Telephone Engineers

Early in 1908 the Hungarian Telegraph Administration proposed the holding of a conference of Government Telegraph and Telephone engineers, for the discussion of technical and other questions which are of vital interest to this important section of electrical engineers. The first conference was held at Budapest, September, 1908. At that time it was decided to hold a second conference in 1910, which will be held at Paris during the present year. The proposed program of subjects for discussion is as follows:

Manual and Automatic Telephone Exchanges.

Standardization of Telephone Circuits.

The Frequency and, if Necessary, the Voltage to Be Adopted at the Terminals of the Secondary With a View to the Assimilation of the Telephone Current to a Sinusoidal Current in Order to Simplify Theoretical Research.

The Adaptation of Telephone Apparatus (Induction Coils, Microphone Resistance, etc.) to Lines.

The Coexistence of Strong and Weak Current Lines.

Long Distance Telephony (Construction of Long Distance Cables, Relays and Combination of Aerial Wires).

The Latest Processes for the Preservation of Wood Poles, by Impregnation and by Protective Structures, and Practical Data Relating Thereto.

The Party Line and Selective Call Systems on Telephone and Telegraph Circuits.

Telegraph Systems for Heavy Traffic (Mechanical, Multiplex Telegraphy and the Mercadier System).

DEPARTMENT of RAILWAY TELEPHONES

Operation of the Gill Selector

By G. K. Heyer

THE telephone in railroad service is called upon to meet the following conditions:

1. Long lines ranging up to 250 miles in length. 2. A large number of stations on each line. 3. The control of the circuit to be in the dispatcher's hands.

Due to the fact that much stronger currents can be sent out over the line for operating signaling apparatus at distant offices, all long distance work in telephony is on a magneto basis. The resistance of long lines prohibits the use of the common battery system (where all current is supplied from some central office), because sufficient current can not be economically provided to operate the relays or other devices at the distant end of the line. Magneto service is generally given also on lines running through rural communities, because in such cases it is necessary for the sake of economy to put many instruments on one circuit. With this arrangement all of the bells on the line operate when any of the stations are signaled.

Fig. 1. Dispatcher's Station on D., L. & W.

It is obvious that to have all the bells on a circuit ring every time any one station is called is most undesirable in railroad work. Experience has shown that the dispatcher generally wishes to call only one station at a time and seldom more than four or five. If, then, all the bells operated every time the dispatcher called a station on a line having between thirty and forty stations, as is usually the case on the rural magneto line, there would be no saving in time of calling over the telegraph system.

It was therefore necessary to arrange a telephone train dispatching circuit so that each station could be called independently of the others by the dispatcher. This is technically known as selective signaling, and the instrument which accomplishes it is called a selector.

The train dispatching system which has been adopted by a large number of railroads today comprises the Western Electric telephone system and Gill selectors. The Gill selector is shown in Fig. 4 and described later. The Gill system of calling is known as the bridging system, so called from the fact that the selectors are bridged across the telephone line at each station. This scheme obviously has the advantage that in case of trouble at any one station that station only is affected. The remainder may operate normally. It is the same principle as that involved in the present day system of incandescent lighting, where the lamps are wired in multiple and the burning out of one lamp affects that lamp alone.

In the ordinary bridged magneto lines, the bells are simply connected across the line, the resistance of the bells generally used being 1,000 ohms, 1,600 ohms and 2,500 ohms, the type of bell used depending on the length of line and number of stations. The selective system used by the railroads

Department of Railway Telephones

This department is established as a permanent feature of Telephone Engineer. The progress of the art of telephone train dispatching, its technical developments, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of Telephone Engineer in all parts of the world whose interests lie along these lines.

Operation of the Gill Selector. By G. K. Heyer.....179-181
Railroad Telephone Operators in Telegraph Union..... 181
D. L. & W. President Favors Telephone..... 181
Telephone for Train Dispatching. By K. W. Endres.....182-183
Lightning Protection for Railroad Circuits. By Otto Holstein.....183-185
Railway Signal Board Reports on Telephones..... 185
Railway Telephone Association.....185-186
Telephone Train Dispatching News..... 186

is shown by drawing in Figs. 3 and 5. Here it will be noticed that the bell is operated in a local circuit upon contacts of the selector itself, the selector relay being bridged across the line.

The selector can also, however, be arranged to operate from the central battery at the dispatcher's office. It is wound to a resistance of 4,500 ohms and is so designed that it offers a very high impedance to telephone talking currents. In other words, a large number of these relays can be bridged across a telephone line without injuring the volume or quality of the transmitted speech.

Inductance, or, as they are commonly known, "choke" coils, are installed in series with this relay to choke back any lightning discharges which may come in over the line. These protect the selector by offering high impedance to the oscillatory lightning current and force such currents to discharge across the lightning arrester spark gap to ground.

The relay shown in Fig. 4 above mentioned operates the selector mechanism, which is merely a special modification of the ordinary ratchet and pawl principle. This selector was developed some years ago for use on telegraph circuits. By its use the dispatcher is able to call selectively any station on the line. The essential features of this selector are a step up selector wheel and a time wheel which normally is held at the top of an inclined track. The operation of the selector magnet allows the wheel to roll down the track. If the magnet is operated rapidly the wheel does not get clear down before being pushed back again by an arm connected to the armature. A small pin on the side of the pawl engaging the selector wheel normally opposes the selector wheel teeth near their outer points. When the time wheel rolls to the bottom of the track, however, the pawl is allowed to drop to the bottom of the tooth. Some of the teeth on the selector wheel are formed so that they will effectually engage with the pawl only when the latter is in normal position, while others will engage only while the pawl is at the bottom position; thus innumerable combinations can be made which will respond to certain combinations of rapid impulses with intervals between. The correct combinations of impulses and intervals steps the selector wheel clear around so that a contact is made. All other wheels fail to reach the contact position because at some point in its revolution the pawl has slipped out, allowing the selector wheel to return home.

The sending apparatus consists of a cabinet containing one key for each station, shown in Fig. 1. By giving the key a quarter turn, a train of gears is set in motion as the key returns, which delivers to the line a succession of impulses and intervals corresponding to the particular arrangement of teeth in the corresponding way station selector wheel. Keys can be added, removed or substituted in the cabinet at will.

A concrete example may make this clearer. It cannot well be explained without having the apparatus for inspection. The dispatcher may throw key No. 1421. This means that this key starts a clock-work mechanism which impresses at regular intervals on the telephone line direct current impulses in the order and number noted—1; followed by 4; followed by 2; followed by 1. There is on the line one selector corresponding to this combination, and it alone, of all the selectors on the circuit, will step its wheel clear around so that contact is made and the bell rung. On all of

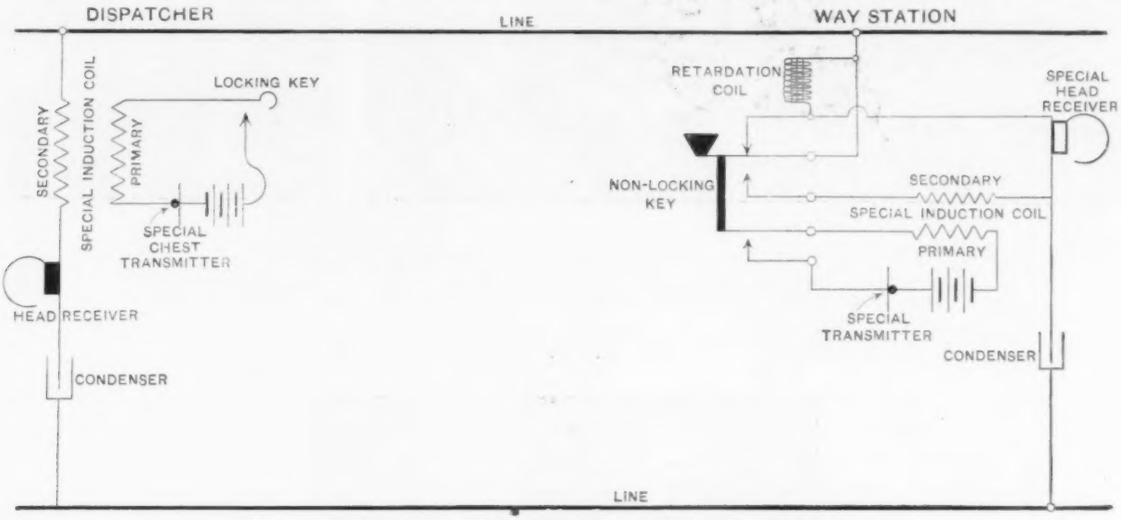


Fig. 2. Dispatching Circuit Showing Wiring of Dispatch's and Way Stations.

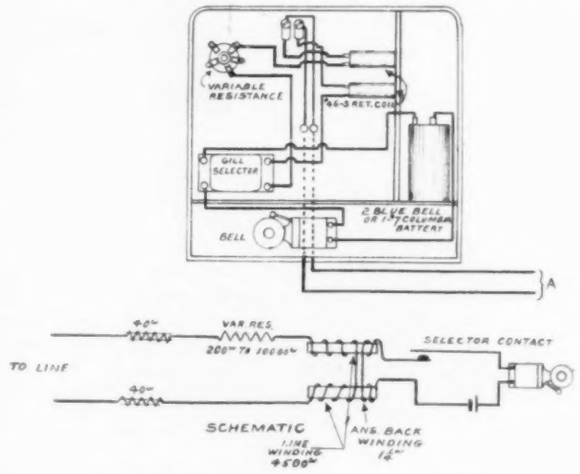


Fig 3. Wiring of Gill Selectors at Way Station.

the others the pawl will have slipped out at some point of revolution and the wheels will have returned home.

On Fig. 3 it will be noticed that a few windings of the local bell circuit are placed on the selector magnet. These provide what is known as the "answer back" feature. The operation of the bell through these turns induces an alternating current in the selector winding which flows out on the line, and is heard as a distinctive noise by the dispatcher. In this way, the dispatcher is always certain whether or not the way-station bell has rung, since he cannot get this noise except by the operation of the bell.

A variable resistance will also be noted in series with the selector magnet on Fig. 3. Each selector requires approximately 0.01 ampere at 46 volts to operate it. The battery for operating it is located at the dispatcher's office, of course, and impulses from this battery are sent out by his sending keys. The voltage at points near the dispatcher would have to be, therefore, very high compared with the voltage at the end of the line, and the variable resistances serve to reduce the voltage at each way-station so that every selector gets approximately the same current and the same voltage. The values of this resistance are high for way-stations near the dispatcher, and taper off gradually to zero at the end of the line.

The new high efficiency transmission circuit is shown in schematic form on Fig. 2. There are usually three tricks of dispatchers, each of which is provided with a head receiver and chest transmitter. This is connected to the line by means of a plug and jack. The receiver is a standard one of 70 ohms resistance. In some cases, double head receivers are used which serve to keep external noises out of the dispatcher's ears. The transmitter has a special button, especially designed to give the very best grade of speech in this class of service. The induction coil is also special to give the best possible transmission consistent with good receiving.

The dispatcher is provided with a locking lever key for closing the transmitter circuit. In some cases, a foot-switch is used for this purpose. A bell may be provided, by means of which the way-station operator can call the dispatcher in case he lays down his telephone set for any reason. Ordinarily, the dispatcher is permanently connected to the telephone line, and all that is necessary for a waystation operator to do

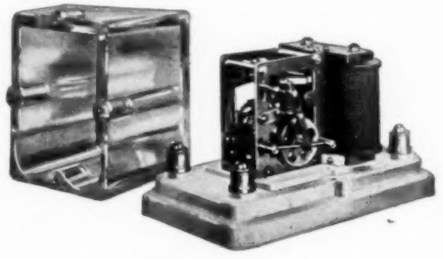


Fig. 5. Gill Station Equipment.

in order to call him is to take the receiver off the hook, press a key and speak into the transmitter.

The transmission circuit for way-stations shown on the same drawing is of a design which is the outcome of difficulties experienced when a number of operators were listening at once. This would ordinarily reduce the transmission so that the speech obtained would be very poor. With the arrangement shown, however, the operator presses a push button key when transmitting and releases it when listening. In the latter case, the 700 ohm receiver is directly across the line in series with a condenser.

When talking, the secondary of the induction coil is bridged across the line in series with a condenser.

Fig. 4. The Gill Selector.

The receiver in series with a retardation coil is bridged around the induction coil. The retardation coil is for the purpose of preventing excessive side tone and increases the impedance of the receiver circuit which is a shunt on the induction coil. The coil, however, will allow sufficient current to flow in the receiver so that the dispatcher can interrupt if he desires. The induction coil and transmitter have the special characteristics noted above in the cases of the dispatcher's equipment.

Railroad Telephone Operators in Telegraph Union

The Frisco System's telephone operators have joined the telegraphers' organization to enable them to receive the same salary and consideration at the hands of the company as has in the past been accorded to the telegraphers, according to a statement of an officer in the telegraphers' union. It took considerable persuasion on the part of the telephone operators to receive admission into the telegraphers' organization, but since their admission the telegraphers have decided, without exception, to stand by the telephone operators to a unit, realizing that they are being required to perform the same service as rendered by the telegraph operators with a different instrument, the result of service being the same.

The telegraphers are not adverse to the use of the telephone, realizing that good service is the major requirement to employment, and in their employment they are willing to bring into use such instrument as their employers desire to be used.

D. L. & W. President Favors Telephones

President Truesdale of the Lackawanna Railroad incorporates the following words in his annual report for the year ending December 31, 1909, under "Additions and Betterments":

"Further expenditures were made in the construction of telephone lines, so that at the close of the year all the main and branch lines of the company were equipped therewith, and all dispatching of trains can be done by telephone instead of the telegraph as in past years.

"A most valuable and important advance in this branch of railroading has thus been effected."

The Telephone for Train Dispatching

By K. W. Endres

ONE of the most important innovations which has taken place in the history of railroading is that being put into effect now by many of the railroads throughout the country, namely, a new modern method of dispatching their trains. The telephone is gradually replacing the telegraph for this service on all the big railroad systems in the United States, and with its arrival, departs one of the most conspicuous features that has accompanied railroading since its early beginnings.

The telegraph and the railroad grew up together and although the telephone has been in commercial service for over thirty years now, it has never broken into this combination to any extended degree until the past couple of years. In these two years, the telephone manufacturers have turned their attention to showing the railroads that the telephone could be made, and was, superior to the telegraph for dispatching their trains. The result is showing up now in the rapid extension of telephone service in dispatching throughout the country.

It has been a hard struggle to convince the men who are operating train movements over our great systems that the telephone was superior to the old standard method which they had been using for years and years. They had to be convinced first of all that its safety was absolute; that there was no chance of a mistake being made due to the fact that directions and orders were not clearly understood. That this has been done, marks a victory for the telephone.

A train dispatcher must be a man who never makes a mistake, because mistakes in his business are nearly certain to be paid for by a toll of human lives or by a wreck-heap of valuable freight running into the tens of thousands of dollars. The aim throughout in train dispatching is to eliminate mistakes and the result of the effort which has been extended along this line is in the development of experienced men and first-class machinery to handle unbelievable numbers of trains in all kinds of complicated and intricate maneuvers without accident and without delay.

Time is a great essential in handling train movements. With the telegraph a dispatcher has always been limited to the speed at which the ordinary operator can receive messages and work the key, and this speed, even with the most expert men, would not average more than fifty words per minute. Taking the grade of operators which railroads must oftentimes employ at their way stations, due to the actual lack of such operators in the market, it may safely be said that the average speed of telegraph operating is much lower than fifty words per minute in railway dispatching service. Now with the telephone it is easily possible to speak one hundred words per minute and the gain in time is obvious. Furthermore, the operator at the way station writes it down as he receives it. The telephone therefore eliminates one chance for mistakes which has been existent with the telegraphic method in that the dispatcher sent his message and then wrote it out as it was repeated back to him by the way stations. This, of course, gave mistakes a chance to creep in. Now the dispatcher can call in as many station operators as he wishes, can give them the train orders and have each man repeat the order back to him word by word, spelling out stations and figures and underlining each word as it comes in. The actual results in the two years the telephone has been in use in this country for this purpose have shown that not a single accident has occurred due to the telephone method of dispatching.

Another great advantage which the railroads did not appreciate until after they had their new system in operation, was the gain that resulted in discipline and coöperation between the men. It is a funny phase of human nature, but it seems to be a fact and not an especially surprising one, that when a way station operator can call up the dispatcher and say, "Bill, No. 32 just passed." he feels much better acquainted with that dispatcher than if he said the same thing by means of a series of dots and dashes. One dispatcher said that he had never been mad since the telephone system had been put into operation, and that expresses the whole story.

It is obvious that no matter how mechanical a telegraph operator becomes and no matter how instinctive the translation of telegraph signals from dots and dashes to letters of the alphabet becomes, there is always a nervous strain on the operator. The continual click, click, click, gets on his nerves unconsciously and the handling of the key tires his muscles and affects his temper. Sarcasm is not at all unknown among telegraph operators and the messages that flash over the wires when a poor operator cannot handle the Morse being sent him, are usually very pointed. This has all been eliminated by the telephone.

The system about to be installed on the Georgia Railroad will equip the division between Augusta and Atlanta, Georgia, a distance of 171 miles; and from Camak, Georgia, to Macon, a distance of 74 miles. This line will consist of a No. 9 B. & S. gauge hard drawn copper wire circuit and on this circuit will be installed forty-eight regular selector stations and five siding telephones. The Georgia installation is the first one in that section of the country.

The operation of this system may briefly be described as follows: In front of the dispatcher is a cabinet of keys, one for each station on the line. He calls any station he desires by giving the handle of that particular key a quarter-turn to the right. This starts a clock-work mechanism which sends out a series of current impulses and intervals on the line. The particular selector corresponding to this combination of impulses and intervals will step its mechanism all the way around and ring the bell at that station. The selector is a piece of mechanism known as the "Gill Selector" and operates on the principle of the ordinary ratchet and pawl, like the escapement in a clock. By means of this piece of apparatus, a dispatcher is able to call any one station on his circuit without ringing the bell of any other way station. When a way station wishes to talk to the dispatcher, all that the operator has to do is to remove his tele-

phone receiver from the hook, press a button and talk to the dispatcher who is connected on the line at all times.

The telephone system is remarkably flexible. Selector stations such as have been described can be added or removed from the line at will. Furthermore, telephones can be installed at regular sidings, blind sidings, draw bridges or in fact at any points on the line where the operating officials wish to place a set. In this way train crews may be placed in direct communication with the dispatcher and may receive orders from him directly without the intervention of an operator. Often times it is possible to omit small way stations simply by installing a telephone at the point desired.

The telephone system also permits of trains being equipped with portable telephone sets. The value of these in emergency service is incalculable. In case of a wreck the train crew can get into immediate touch with the dispatcher and through him with the officials of the line and can give on the spot those details which will enable the proper assistance to be sent out; these portable sets are attached to the telephone line by means of a jointed fish-pole and can be hooked on at any point whatever.

Other railroads in the south which have recently been very active in adopting the telephone method of handling train movements are the Southern Railroad, which has purchased from the Western Electric Company full equipment for the installation of telephones and selectors on one of its divisions; the Chespeake & Ohio has completed the installation of similar equipment on its Cincinanti division and expects to have installed within a short time telephone dispatching apparatus on three other important divisions; the Norfolk & Western Railroad is equipping 700 miles of its main line, which includes six dispatchers' districts, with telephone equipment, and already has a portion of this in operation, planning to cover its entire system with this equipment as soon as possible; the Seaboard Air Line has installed the same system on two of its most important divisions and reports that the operation of the telephones is so satisfactory that further extension is being contemplated; the Atlantic Coast Line has been handling trains on one division for some time by this method, and is at present extending its service along the same lines; the Carolina, Clinchfield & Ohio operates trains over its whole system by the telephone method. The system employed by all these railroads is practically uniform throughout. It is what is known as the Western Electric-Gill system.

Manufacturers report that they are being so rushed with orders from the railroads throughout the country for this equipment that they are behind in their orders at present and are increasing their equipment to turn out the material. They have standardized telephone train dispatching apparatus and the railroads are employing specially designed instruments of solid construction which will withstand the severe service that they are liable to meet in this type of work. Telephone train dispatching is at present a very live issue throughout the country and especially in the south.

Lightning Protection for Railroad Circuits

By Otto Holstein*

HAVING had a number of years experience in the southern states and western states and territories in the United States, in the Philippine Islands, on the Isthmus of Panama, in Peru, and on ships at sea, my knowledge of electrical storms and the protections of wires and apparatus from their effects may be of interest.

From my observation in these widely separated parts of the world, I can say that nowhere have I encountered electrical storms of such magnitude as those of the higher altitudes of the cordillera of the Andes. It is very probable that in the Rocky Mountains as well as in many other parts of the world, where altitude, temperature, latitude or geological formation, or whatever it is that bears the most important relation to the phenomena in question, are as favorable as here, electrical storms of equal proportions will be encountered.

Inasmuch as the Peruvian Andes comprise the territory directly in question, some little description of this great range of mountains may not be out of place. The description of the Sierra in Peru will hold good for the whole west coast of South America, as the general character of the country is the same. The country on the western or Pacific slope of the mountains is dry and barren, very much like the Mojave Desert in California and Arizona. There is little or no rain along the coast, but up above the foot-hills we get rains for six or seven months of the year. About the altitude of 10,000 feet, rain, snow and electrical storms are frequent and very violent, although usually of short duration during the summer. On the high peaks and in the passes and through the higher altitudes the storms, generally, both rain, snow and electrical, are of the greatest violence.

On the Cerro de Pasco Company's line, upon which I was formerly employed, the entire length of which lies above an altitude of 12,000 feet, the road follows the canyon of a river for the first thirty kilometers from Oroya and then opens out on a level plain, or, as it is known here, "pampa." The road crosses the entire length of this pampa, some 70 kilometers and then enters the barren mountains in which it continues for another 30 kilometers until Cerro de Pasco is reached. This is on the eastern or Atlantic water-shed of the Andes, and here, as well as other places of the same altitude (over 14,000 at Cerro de Pasco), the electrical storms are very violent.

These storms come with almost no warning. I found the telegraphone gave the best indication of the approach of a storm; the "howler" would give notice of the presence of static electricity long before any sign was visible to the eye. To those who are familiar with wireless telegraphy and have sat for hours trying to read faint signals from a distant station or ship, I

*Paper read before the Railway Signal Association.

could best describe the noises made by the "howler" as very much like "bad static"—or, better, a sound like water spilled on a hot stove. The clouds seem to collect from nowhere, around some peak, and in a very few minutes the vicinity of the peak is ablaze in a terrific electrical storm.

Although these storms frequently come alone, they more often accompany heavy snow storms, frequently coming after it has been snowing quietly for a half hour or so, and, after from fifteen minutes to half an hour of blinding flashes and pealing thunder, disappearing as suddenly as they come.

Many horses, cattle, sheep, and llamas, and people as well, are killed each year by lightning. The lightning seems to find more victims on the pampa than in the more rugged country. The peaks are rich in mineral and probably offer a better conductor than frozen pampa covered with comparatively dry snow. I have noticed among the peaks static appears to be disposed of with greater facility than on the pampa where it plays more pranks before finally disappearing.

A lightning arrester, known as the "Argus," is used on the Cerro de Pasco line, for the protection of telegraph and telephone apparatus and also for the protection of the train staff machines, which are in use there. In the case of the telegraph, these arresters have done excellent work. During one storm at Carhuamayo, a station on the Cerro de Pasco Railway, the lightning arrester was completely destroyed by a heavy discharge while the telegraph relay was not damaged. During another storm at La Fundicion, on the same road, the helix of the arrester was fused, but no damage was suffered by the telegraph apparatus.

The results obtained in the case of the telegraphones were not so gratifying as in the case of the telegraph apparatus, for, although the current that got through the arrester before it reached an intensity sufficient to break down the resistance of the air gap between the helix and the ground plate, was not sufficient to cause any damage to the telegraph relays, it was sufficient to puncture the comparatively delicate oiled-paper tinfoil condensers used to bridge telegraph instruments in intermediate offices and in telegraphone circuits where these instruments were installed. I have spoken of the excitement of the "howler" on the approach of an electrical storm, and the "howlers" as well as condensers were destroyed almost every time we had a storm. The howlers, when not destroyed, seemed to become less sensitive after a storm and a large number of howlers and condensers had to be ordered to replace those damaged by the frequent electrical storms. The condensers in way stations gave us a great deal of trouble and after a storm if a telegraph station did not answer after some hours of calling, it was almost certain that the office had been cut out by a short-circuited condenser. We finally put two-pole single-throw cutout switches in all telegraphone circuits as well as in condenser circuits at intermediate offices, with instructions to open switches on the first appearance of a storm. Naturally this put the telegraphone out of commission during such storms, but it was just as well so, for things were usually so interesting in the offices upon these occasions that I never heard anyone express a desire to use the telephone during an electrical storm.

In the case of the train staff, the Argus arrester was also used, and, in addition, cut-out switches as in the case of the telegraphones. I never found out whether the staff machines were more susceptible to the action of lightning than the telegraph relays or not, as the machines were comparatively expensive, and as we had no spare ones to replace a damaged machine, we did not deem it wise to take a lesson from that all-wise teacher, "experience." During storms the telegraph was used to notify operators to close switches, to give or take a staff.

As stated in the case of the telephone, the Argus arrester gave excellent results, and I have in my possession at the present time, three arresters that have been all but completely destroyed by lightning discharges.

While the Cerro de Pasco line lies throughout its length in a country where the same conditions obtain, all imaginable weather as well as other conditions are found on the Central Railway of Peru. In Callao and in Lima, and for some distance from the coast, it seldom or never rains, and home-staying people of the coast know nothing of rains or electrical storms. Higher up in the cordillera of the Andes rain and snow and electrical storms are encountered the same as in the Cerro de Pasco country.

I cannot do better than take three stations on the Central where electrical storms are very destructive: Ticlio at the entrance of Galera Tunnel, the highest point on the line at an altitude of 15,665 feet and on the continental divide; Casapalca, 18 kilometers west of Ticlio and on the Pacific slope of the mountains at an altitude of 13,606 feet, and Yauli, 22 kilometers east of Ticlio and on the Atlantic slope of the Andes at an altitude of over 14,000 feet. During the summer months, which are December, January, February and March, snow and electrical storms are of daily occurrence at these stations. The worst months for such storms are January and February and any person wishing to study electrical phenomena could not find a better field than the one outlined.

Here on the Central I found a type of lightning arrester that was entirely new to me. The arrester in question embodies so many good features, and its performance has been so satisfactory on this road, where very trying conditions are to be met, that I consider it worthy of some further description.

The principal parts of this device are of cast iron, the arrester is the two-line type.

The ground plate measures 7¾ inches by 6 5-16 inches and stands on four legs cast with the plate. The whole upper surface of this plate is furrowed and sharply ridged. The line plates are likewise furrowed. The arrester, when assembled has these sharp ridges at right angles, making every point of intersection (of which there are thousands) a spark-gap with an air space of but one thirty-second of an inch to break down. As can be seen, thousands of small spark-gaps in multiple with but one thirty-second of an inch of air resistance to break down, impose but a negligible resistance to a static discharge of any intensity.

The line plates and ground plate are separated by hard-rubber or ebonite washers one thirty-second of an inch in thickness and the line plates are held in position by sentinels of the same material which are secured to the ground plate and which clamp the washers in position. On the line plates brass lugs are secured which also serve to hold the line plates

in position; these lugs are insulated from the ground plate by a strip of ebonite that extends along the sides of this plate.

The plates to which the line is connected can be lifted from the ground plate for inspection or for cleaning without interfering with the working of the wires. The only fault that can be found with these arresters is that they are rather heavy, the weight of the two-line type being about fifteen pounds.

The records of this road show excellent performance for this type of lightning arrester. There are records of some violent storms where office and ground leads have been fused by static electricity but none of the instruments have been lost.

The original manner of arranging the arresters was to connect them in series with the line and instruments and, inasmuch as they appear to have done their work so connected, it might seem best to let well enough alone, but I have put choke coils in series with the line plates of the arresters and the instruments with a view of still further retarding the passage of the high frequency discharge causing it to bank up and break down the resistance of the arrester sooner than it would otherwise, thereby offering greater protection to the instruments. Good ground leads have also been sought and both binding posts of the ground plate have been connected with separate grounds. A flat copper ribbon is used for the ground conductor, this form appears to embody qualities not possessed by round conductors.

Railway Signal Board Reports on Telephones

In its second annual report to the Interstate Commerce Commission, the Block Signal and Train Control Board says:

"An important part of the board's work during the past year has been the inspection of the personnel of telegraph offices and block-signal stations, and the method of operation pursued in such offices on a number of prominent railroads. This inspection was begun because of the occurrence during the past three years of a considerable number of collisions of trains in consequence of errors or neglect on the part of telegraphers. The reports of these inspections afford a great mass of information concerning the conduct of telegraph, telephone and manual block-signal departments of railroads generally. Telegraph operators holding responsible positions without having received more than superficial instructions are common on a number of important roads. On one road a new book of rules was introduced without formal examination of the men on the changes. On certain large divisions of western roads the indications of inefficient supervision are confirmed by records showing that 25 per cent or more of the station offices become vacant yearly by reason of dissatisfaction on the part of the men or by their dismissal because of unsatisfactory service. On the other hand, the strictly managed roads show records of hundreds of offices with few or no appointments in a whole year. Since the date when the federal nine-hour law came into operation many offices, manned by three telegraphers, have for the 'third trick' one noticeably deficient in experience or other qualifications, while the other two operators are better; though, of course, the need of having one entirely reliable is almost or quite the same throughout the twenty-four hours.

"In the dispatcher's offices, the 'nerve centers' of the train-running department of all busy single-track railroads, inefficient management has been found in a number of cases, and in a few the faults of practice have been such as to nearly or quite warrant the use of the term 'dangerous.'

"The use of the telephone in train dispatching, which has been greatly extended during the past year or two, introduces some new conditions which ought to be investigated. With the telegraph nearly all the operators have always learned to send and receive in the railway telegraph offices. This learning period, extending over many months, has given each learner a valuable opportunity to acquire a good knowledge of the office work and incidentally a good deal about train operation by observation. With the telephone no such extended train period is necessary, and both young men and women are taken into offices and charged with responsible duties, when they have had little or none of the training that comes from contact with actual work. Not many cases of this kind have been specifically named, but the indications, in connection with other things observed, clearly evidence the importance of keeping informed concerning these features. The superintendent who is reasonably cautious takes care, of course, to intrust no person with the responsible duties of station telegrapher or block signalman, until that person has been under tutelage for as long a time as may be necessary; but superintendents are not in all cases reasonably cautious. The introduction of the telephone affords an opportunity to railroads to fill these station positions with men who have been disabled in the train service; men who have much knowledge of railroad work generally, yet who could not readily learn telegraphy because of having passed the youthful age when such learning is easy. Often it is possible thus to give satisfactory employment to such disabled persons and greatly ameliorate their condition. It has been observed, however, that in some cases there has been too ready an assumption that because the disabled person is familiar with train work he is also well informed about station office work. Whatever a person's antecedents, the duties of station operator, either telephone or telegraph, requires that the beginner at the work be very carefully trained."

The Railway Telephone Association

The Railway Telegraph and Telephone Appliance Association, whose organization was recorded in Telephone Engineer for March, has adopted the following constitution:

ARTICLE I.

Name.—This organization shall be known as the Railway Telegraph and Telephone Appliance Association.

ARTICLE II.

Object.—The object of this Association is to make the necessary arrangements for the care and comfort of the members and their guests during the annual meetings of the Association.

ARTICLE III.

Members.—Section 1. Any firm or company manufacturing or selling Telegraph and Telephone or equipment shall be, through their representative, eligible to membership, after said representative has become an associate member of the Association of Railway Telegraph Superintendents.

ARTICLE IV.

Dues.—Section 1. The dues shall be twenty-five dollars ($25.00) for each member, which entitles each representative present of said member (not exceeding four) to a badge.

Members may secure additional badges for their representatives in excess of four at $5.00 each.

Section 2. In case of extraordinary expenses, there may be an arbitrary assessment made by a majority vote of all members present at any regular meeting.

ARTICLE V.

Officers.—Section 1. The officers of this Association shall be a Chairman, a Vice-Chairman and a Secretary-Treasurer, who shall be elected by ballot at the annual meeting. The Chairman shall hold office for one year or until his successor shall be elected or appointed, and is not eligible to succeed himself. The Vice-Chairman and Secretary-Treasurer shall hold office for one year or until their successors shall be elected or appointed. There shall also be an Executive Committee composed of six members, three of them shall be nominated and elected annually to serve for a term of two years.

The members of the Executive Committee shall for the first year be elected to serve as follows: Three for one year and three for two years.

The Chairman and Vice-Chairman shall be ex-officio members of the Executive Committee.

Section 2. In balloting for officers the vote shall be restricted to one representative for each firm present at the annual meeting.

ARTICLE VI.

Duties of Officers.—Section 1. It shall be the duty of the Chairman to call and preside at all meetings of the Association, take the vote on all questions of debate, preserve strict order, appoint all committees. In case of a vacancy among the officers of the Association he may appoint an Active member to serve until the next regular meeting of the Association, at which time the vacancy shall be filled by election. He shall perform such other duties as may pertain to his office, and be an ex-officio member of all committees. The Vice-Chairman shall perform the duties of the Chairman in case of his absence or disability.

Section 2. In the absence of the Chairman and the Vice-Chairman the Secretary shall call the meeting to order, and the members shall elect viva voce a presiding officer.

Section 3. It shall be the duty of the Secretary to keep an accurate account of the attendance and proceedings of the Association. He shall notify members of the meetings, and officers of their election. He shall make a report at each annual meeting.

Section 4. It shall be the duty of the Treasurer to keep a faithful and accurate account of all moneys received and disbursed by the Association. He shall collect all moneys due, giving his receipts therefor, and pay all bills contracted when approved by the Chairman, and at each annual meeting render a detailed statement of the same. The funds in the hands of the Treasurer, after all expenses have been paid, shall be rebated prorata to the contributing members.

Section 5. It shall be the duty of the Executive Committee to act in an advisory capacity to the officers of the Association, to decide all questions which may be referred to it between the annual meetings, and its decisions shall be final. It shall audit the accounts of the Association, (making report at each annual meeting), and its authority shall be necessary before any extraordinary expenses are incurred. The Executive Committee shall also order *special* meetings of the Association through the Chairman, as the interests of the same may require.

Meetings.—Section 1. The annual meetings of the Association shall be held during the time that Association of Railway Telegraph Superintendents holds its annual meeting.

Section 2. The Chairman shall call special meetings of the Association at the request of the Executive Committee, which request shall set forth the reason for the call.

ARTICLE VII.

Amendments.—The Constitution may be amended or revised at any regular meeting of the Association by a two-thirds vote of the members present, but no such amendments shall be considered unless the same shall be submitted in writing to the Association one meeting previous to that upon which the vote shall be taken.

The executive committee is composed of: The chairman; the vice-chairman; W. E. Harkness, Western Electric Company, 463 West street, New York; H. E. Merrill, U. S. Electric Company, 284 Pearl street, New York; F. R. Chambers, Jr., Duplex Metals Company, New York; A. B. Saurman, Standard Underground Cable Company, San Francisco, Cal.; C. E. Brown, Central Electric Company, Chicago, Ill.; H. O. Rugh, Sandwich Electric Company, Sandwich, Ill.

Telephone Train Dispatching News

The Santa Fe System has extended the use of the telephone for train dispatching over its road from Denver to Pueblo, Colorado. The officials of this road were among the first to recognize the advantages of the telephone for dispatching. Telephones have been installed over approximately 1,950 miles of the Santa Fe lines, and it is planned to extend the equipment on other sections of the road as soon as possible.

There are about forty telephone stations on the 120-mile stretch between Denver and Pueblo, and here telephone equipment and Gill selectors supplied by the Western Electric Company have lately been installed. Heavy traffic is carried on over this single track division. There are in the neighborhood of 25 to 30 trains a day, and in the handling of these trains there are approximately 75 regular meeting points. This section of the track is used jointly by the Santa Fe and the Colorado and Southern railways. The dispatching, however, is all done from Pueblo by the Santa Fe.

It is estimated that the installation of telephones on this division will enable the dispatchers to handle the same amount of work as previously in about sixty per cent of the time.

Department Changes

Edwin C. Keenan has been appointed superintendent of telegraph for the Lake Shore & Michigan Southern, the Lake Erie, Alliance & Wheeling, and the Dunkirk, Allegheny Valley & Pittsburg Railroad Companies, with office at Toledo, Ohio, succeeding Wm. Kline, retired.

W. L. Connelly will jointly represent the Chicago, Indiana & Southern, and the Indiana Harbor Belt Railroads in the capacity of superintendent of telegraph, with office at Gibson, Ind., having been appointed to succeed Thos. Brennan, who has been transferred.

Messrs. Egner and Holmstrom, the Swedish engineers, who recently invented a telephone apparatus which is proving very satisfactory in telephoning great distances, state that it has been installed in the Stockholm's Handels Bank, and the Banking House of Warburg, Hamburg, where it has been found very efficient. The Swedish telegraphic department has acquired the right of manufacturing the new apparatus, which will probably be made by the L. M. Ericsson Company, Stockholm. It is the intention to use the long-distance telephones between Sweden and Germany, and later to extend their use to other countries.

The telephones installed upon the steamship "Lusitania" present some interesting features. A white enamel box incloses the induction coil, condenser and bell of the instrument, and the switch hook, which projects from one side of the box, is provided with a special retaining device which prevents the receiver being knocked from its place by the ship's motion. This device allows the receiver to rock on its hook, thus preventing the lever from lifting and making a false connection when the ship is pitching and rolling.

Of Interest to the Trade

THE second annual meeting of the Telephone Boosters was held on Thursday and Friday, March 3 and 4, at Pittsburg, Pa. More than 100 delegates, composed entirely of men engaged or interested in the telephone business, attended the sessions, which were highly profitable from the standpoint of business and enjoyment. They came from western Pennsylvania, from West Virginia and Ohio.

The gathering included representatives of independent, sub-licensee and Bell companies as well as men engaged in the manufacturing end of the business. The "Telephone Boosters" are now a well-organized body of enthusiasts, the outgrowth of a meeting of rural telephone men a year ago at Pittsburg.

During May, 1909, this convention was conducted under the auspices of the Western Electric Company in the auditorium of its warehouse in River avenue, North side. So much interest was manifested in the programme of business and pleasure that had been arranged that it was decided to organize permanently and to come together at least once a year. Accordingly all the delegates were asked to interest their friends in the forthcoming 1910 convention.

Upon their arrival in the city on the morning of March 3 the delegates were confronted by a big sign reading "Welcome Telephone Boosters." They came thick and fast, and by ten o'clock registration at the River avenue headquarters was completed. Each man received a Telephone Booster button and another button with a number. A bulletin was posted bearing the names and numbers of all the delegates.

The business end of the convention, which was of course the real purpose of the gathering, was cared for by the attractive and instructive programme. It had been arranged as follows:

March 3, 1910.

10A. M.

Address of Welcome.....P. L. Thomson
"Object of Telephone Boosters"...R. M. Morris
"The A. B. C. of the Telephone".....E. B. Tuttle

—Dinner—

2:00 P. M.

"Building Telephone Lines".....G. K. Smith
"Troubles—How to Find Them and Clear Them".....F. K. Singer
"Questions and Answers".....L. W. Ray

8:00 P. M.

Theater party—Grand theater.

March 4, 1910.

9:00 A. M.

"How to Spread the Benefits of the Telephone".....L. W. Ray
"Telephone Bookkeeping".....L. M. Dunn
"Questions and Answers".....L. W. Ray

—Dinner—

Visit to a Pittsburg Telephone Exchange and points of interest.

Immediately after the close of the first morning session the hungry delegates were taken in special cars to the Hotel Lincoln for dinner as the guests of the Western Electric Company. The ride was made enjoyable with songs. A sample of the Telephone Boosters' efforts in this direction is the song that is printed elsewhere in this issue.

As they proceeded along the streets the delegates were formed in line, two by two, the files extending for three blocks. They held to this formation whenever they appeared in public.

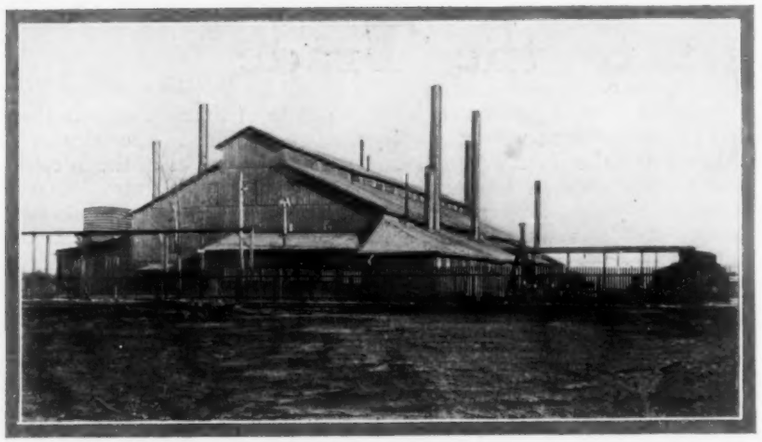
At the close of the afternoon session the men were left for a short time to their own devices. Theater tickets had been provided, and all were to meet at the Grand theater at eight o'clock.

The dinner on the second day was at the invitation of the Central District and Printing Telegraph Company. In the afternoon some of the men visited the Grant telephone exchange as the guests of the company, and a demonstration of the working of the telephone office was given. Another section of the delegates went to the Heinz pickle factory to see other interesting sights.

An excellent view of the greater part of the gathering grouped beneath the "welcome" sign was obtained, and is reproduced here.

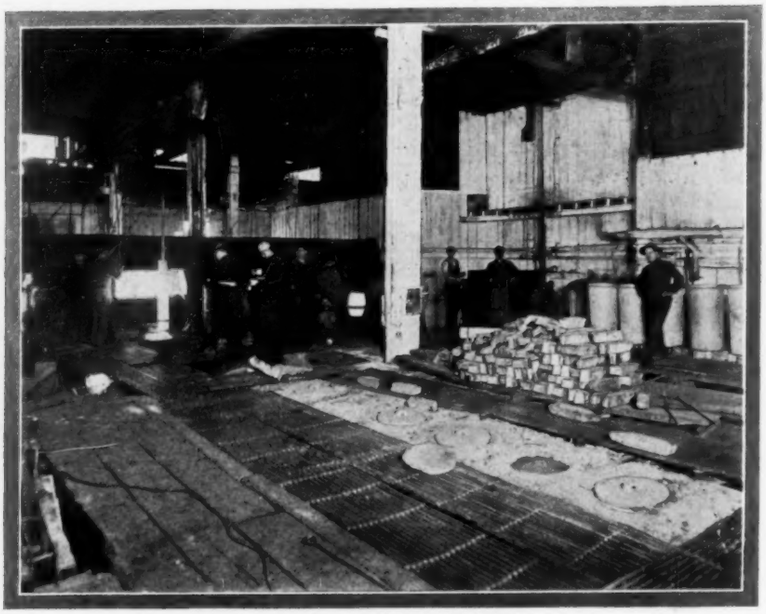
The sessions of the two days in Pittsburg helped to bind more closely the organization of the Telephone Boosters. It is expected to result in another boom for the telephone in the districts about Pittsburg. Further than this, the discussion of topics of vital interest to the rural companies was declared by all to have been of considerable profit.

Group of Telephone Boosters.



View of Factory from the Railroad.

Looking Northeast from the Office.



Coating Room and Crucible Furnace.

The Duplex Metals Company

The home office of the Duplex Metals Company in New York is remarkable in several respects. Occupying the thirty-second floor of the famous Singer building, it is 456 feet above the sidewalk of Broadway and commands a view on all four sides that is absolutely unique. The entire city is spread out like a map at one's feet; across the Hudson and the East River New Jersey and Long Island can be plainly seen for twenty miles or more, while to the south stretches the magnificent New York harbor, and beyond, the ocean. The tall downtown office buildings are dwarfed; the older structures of moderate height are thrown into utter insignificance and the hurrying crowds in the streets look like so many ants.

The view to the northwest shows the piers of the transatlantic steamer lines on both sides of the North River, while to the northeast can be seen the four bridges that connect Manhattan Borough with Brooklyn and Queens. Two of these are shown in the illustrations; the Manhattan Bridge in process of erection and, more prominently, the original Brooklyn Bridge, built by the John A. Roebling's Sons Company, one of the greatest engineering triumphs in the world.

The situation of the new offices could hardly be improved upon. The corner of Broadway and Liberty streets is in the very heart of New York's commercial and financial activity, within five minutes' walk of the Pennsylvania and New Jersey Central ferries and but a stone's throw from the Hudson Terminal with its network of tubes connecting with the Pennsylvania, Delaware, Lackawanna and Western, New York, Susquehanna and Western and Erie railroads. The subway, four hundred feet distant, connects directly with the New York Central and the New York, New Haven and Hartford railroads at the Grand Central Station and also with the Long Island Railroad in Brooklyn, while the elevated railways, just around the corner, and the surface cars passing the door, carry their passengers to and from all parts of the city and make connection with all the suburban lines.

Of the sixteen electric traction elevators in the building four are devoted to the exclusive use of the tower and these are so well managed that visitors reach the offices from the street as quickly as though they were several hundred feet nearer the earth.

Here, with perfect light, pure air and all facilities for conducting a modern business, the executive staff of the Duplex Metals Company does its work, increases its business and welcomes its friends.

The photograph of the factory buildings is not shown as that of a model mill. The buildings are "to keep the rain off the machinery" and that's all. The main building

is 80 feet by 300 feet and includes the coating room, 21-inch, 12-inch, and 10-inch rolling mills, with the necessary shears, cutting off, drilling, and tapping machines, engines, and air blowers.

The separate buildings are boiler house, machine shop, blacksmith shop, pattern storage, and general storehouse.

Shipping facilities are supplied by three railway switches, respectively for fuel, copper, and incoming steel and outgoing copper-clad rods.

Basic open-hearth, low-carbon steel comes to us in the form of six-inch square ingots. These are heated and rolled to, say, five-inch rounds, on the 21-inch mill.

The rounds are taken to the cutting-off machine, cut into 26-inch billets and rolled over to the drilling and tapping machine, where holes are drilled and tapped in the ends.

The surface of these billets is then properly prepared and they are taken to the coating room.

Here they are first given the "alloy film" by dipping in the "tilting furnace." From the alloy furnace they are drawn up into the mould tube and the solid coating of copper cast on by plunging the tube into a crucible of copper.

When the copper solidifies, the billet is pressed out of the tube by a hydraulic ram and is then taken to a furnace, where it is thoroughly "soaked."

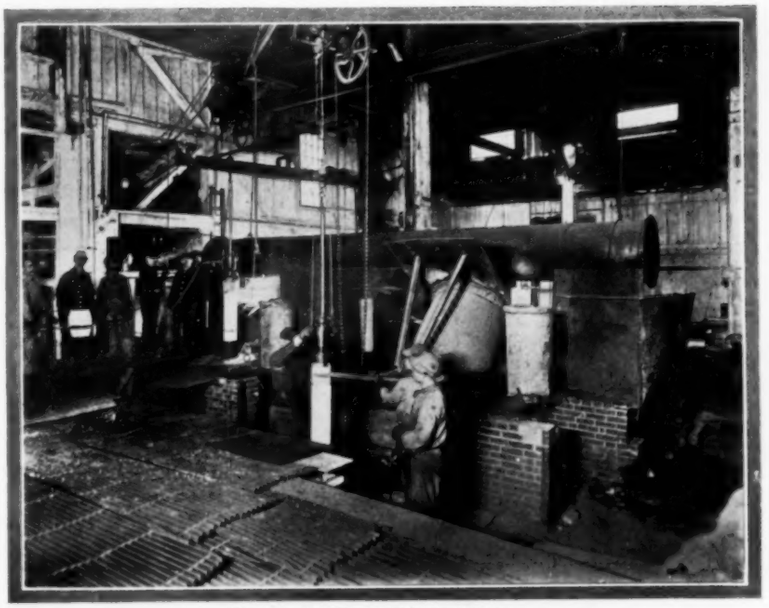
From here it goes to the 21-inch mill, where it is broken down. The ends are sheared to remove the "pipe" caused by the holes previously drilled.

The billet is now reheated and taken to the 12-inch mill, from which it passes to the 10-inch. This produces a wire rod, in the usual practice, three-eighths of an inch in diameter.

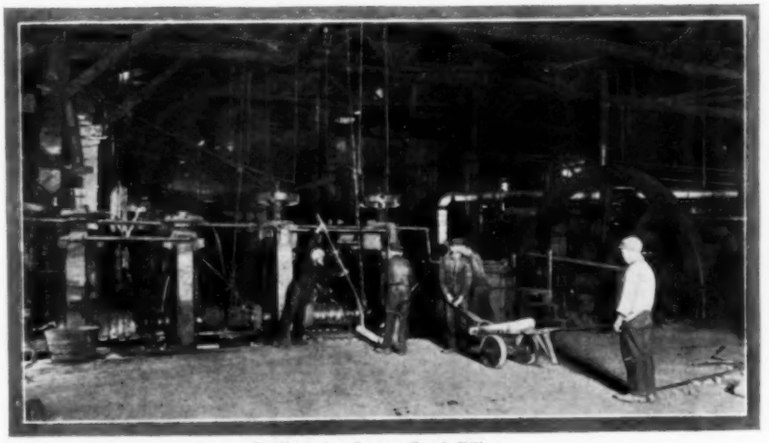
The wire rod is first thoroughly annealed and cleaned, and is then drawn (cold) through dies to form wire.

This drawing must be done with great care, and, it naturally follows, at greater expense than that of either iron or copper.

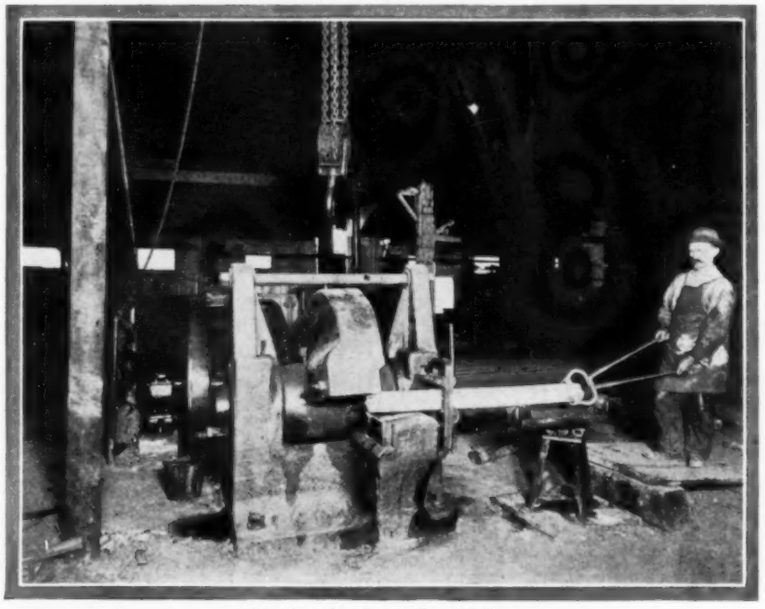
Strength is obtained by drawing as far as possible without producing brittleness, and the result is the finished product—copper-clad steel wire.



Coating Room and Tilting Furnace.



Rolling the Copper-Steel Billets.

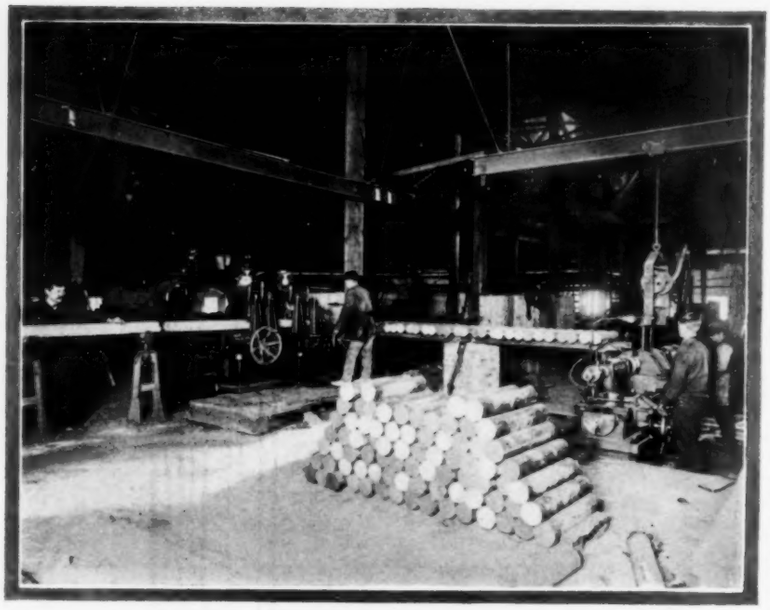


Shearing the Copper-Steel Billets.

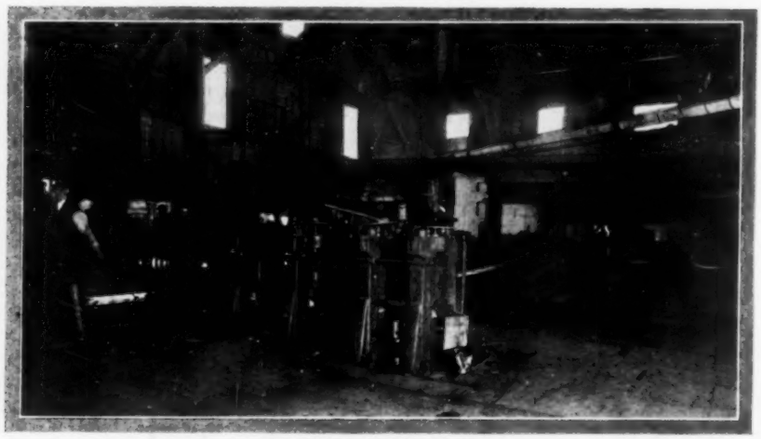
Western Electric Reports

February returns of the Western Electric Company were 60 per cent ahead of the sales for February, 1909, and the first quarter of the company's fiscal year, ending with February, showed more than 50 per cent ahead of the corresponding quarter a year ago.

The extent of this growth is appreciated when it is taken into consideration that the year 1909, with its $46,000,000 gross sales, was the third largest year in the company's history.



Cutting, Drilling and Tapping Billets.



Rolling the Wire Rods.

Drawing the Wire.

A man identified with the Western Electric Company said:

"Probably the precise conditions which brought about the tremendous expansion of the 1906 period will not occur again. But that does not mean that the high record of sales for that year will never be paralleled or excelled, for in the normal growth of the telephone business the time will come when a year's gross sales of $69,000,000 will not seem large. Perhaps it is foolhardy to attempt to read the future, but I feel reasonably safe in saying that from present indications, barring, of course, such unexpected factors as crop failures or panics, 1911 will exceed the high record for 1906."

That the total of the sales for the current year will exceed $61,000,000 is the assurance of the returns for the first quarter. The sales of the company are well distributed. With the opening of the spring season the sales to farmers, which is becoming a very important branch of the business, are commencing to show the usual large increase over the winter months.

No contracts of unusual size have been booked recently, the increase coming from a broad and steady demand.

The Western Electric has made provision through its bond and note financing for a business larger than it has ever handled before.

An Announcement From Vinton

William Montgomery Traer, substantial citizen of Vinton, Iowa, and publisher of our esteemed contemporary, the *Western Telephone Journal*, has embarked upon a new sea. He has taken that solemn and serious step in life which means that henceforth he shall stay home evenings and—but read it yourself:

Dr. and Mrs. Jay Philon Whitney
announce the marriage of
Sarah Halleck
to
Mr. William Montgomery Traer
on Saturday the fifth of March
One thousand nine hundred and ten
Vinton, Iowa.

Hubbard's Peirce Department Moved

The Peirce department of Hubbard and Company, formerly the Peirce Specialty Company of Elkhart, Ind., has been moved to its new building erected at the main works of Hubbard and Company, Pittsburgh, Pa. C. L. Peirce, Jr., manager of the department, when seen last week at Pittsburgh, was enthusiastic over the business outlook. "Since last October," he said, "our volume of business in the Peirce line has broken all previous records, and severely taxed the capacity of the Elkhart plant. This is doubled at the new plant, with provisions for further increasing it."

Kellogg Items

The contract for the new exchange at Dickinson, N. D., has been awarded to the Kellogg Switchboard and Supply Company, Chicago. The new switchboard is to consist of two 1,800 line sections with the following equipment: 540 common battery multiple lines, ten toll lines, twenty pay station lines. It is to have three common battery positions and one toll position, also one toll test panel equipped for ten lines.

The power equipment will consist of two sets of cells, storage battery, one mercury arc rectifier, two Kellogg four frequency pole changers and two sets of transformers in one cabinet. There will be a Monson slate power board to match rectifiers.

The woodwork of the exchange equipment is to be finished in mahogany and the plant will be a model of exchange arrangement and assembling.

The contract was awarded after thorough consideration of the various types of apparatus and is an acknowledgment of Kellogg excellence, both as to details, construction, assembling and operation of apparatus and maintenance.

Another "telegraph fire switchboard" order has recently been filled by the Kellogg Switchboard and Supply Company in record time. The size of the shipment does not always mean as much as the way it is handled to the buyer. The exchange of the City Telephone Company of Randolph, Iowa, was destroyed by fire and the company wired in for a new board. The order was received on a Tuesday at 10 a. m. The next train that could carry the express shipment back left at 9:45 a. m. the next morning, Wednesday, and on this train the one hundred line switchboard, fully wired and equipped, was shipped. The promptness and completeness of Kellogg shipments is well known to the telephone trade and this shipment is a fair sample of the company's co-operation.

The appearance of the Kellogg Switchboard & Supply Company's general office and factory confirms its statement that the month of March, 1910, shows the best business that it has seen for some time. Sales for this period show a total of sixty magneto boards, ten branch exchange boards, four multiple sections, and telephone sales exceeding $11,000.

Electric Storage Battery News

The St. Louis offices of the contract agent of the Electric Storage Battery Company of Philadelphia, which were formerly located in the Wainwright building, were moved on Monday, March 28, to Nos. 1205-6-7 Fullerton building, Seventh and Pine streets, St. Louis. Bell telephone, Main 2728; Kinloch telephone, Central 921.

Mr. Charles Blizard, third vice-president and general sales manager of the Electric Storage Battery Company, has just returned east after an extended trip through the west. Mr. Blizard visited the sales offices of the company at Cleveland, Chicago and San Francisco, as well as spending some time in Seattle and Los Angeles.

The company also advises the appointment, taking effect March 1, of Pierson, Roeding and Company, San Francisco, Seattle and Los Angeles, as its sole Pacific coast selling agent.

Mr. George R. Murphy, now interested with Pierson, Roeding & Company, and who will represent the company in the sale of batteries on the coast, has had ten years' experience in various departments of the organization, and will devote himself exclusively to the battery business, with offices in the Crocker building, San Francisco.

The Pacific coast branches of the construction, operating and exide inspection departments will be continued under the company's control, with offices at 590 Howard street, San Francisco.

Pierson, Roeding & Co. will operate the exide battery depot at 590 Howard street, San Francisco, and will carry an ample stock to insure prompt shipments.

Stromberg-Carlson Literature

The Stromberg-Carlson Telephone Manufacturing Company has issued several new telephone bulletins which will be of great interest to the trade. Two of these headed "Quality Apparatus," pamphlets No. 27 and 28-A, explain in detail the make-up and advantages of the company's No. 890 magneto and No. 896 compact wall telephones. The former is a very compact iron-clad instrument, built especially for mines, outdoor use and places where an instrument is subject to the severest atmospheric and climatic conditions. Its accessibility and lasting qualities are expected to prove good selling points.

The new telephone construction material and supply catalogue for rural telephone lines has been condensed to thirty-six pages with index, and fully lives up to its heading, covering the standard sizes, weights, package quantities and prices of all construction materials.

The attractive cover design of the new bulletin, "How the Telephone Helps the Farmer," is worthy of attention. This bulletin contains numerous cuts of the departments and laboratories of the Stromberg plant and explains in detail the construction and use of its most important and most widely used telephones.

"Telephone Troubles, Their Cause and How to Remedy" treats of the numerous common every-day troubles occurring in bridging telephones and tells in plain language how to remedy them. No attempt has been made to make it a complete telephone manual, but more especially to give information to those who have not had experience with a telephone. The ten leading troubles of a telephone man are cited, and the remedy in each instance seems clear enough to show a "wooden man" how to fix his telephone.

The Stromberg-Carlson Telephone Manufacturing Company will be glad to receive inquiries for these bulletins, and any other information needed.

Automanual Bulletins

The North Electric Company of Cleveland, Ohio, has recently issued several new bulletins exploiting its automanual system. These are very neatly arranged, printed on good stock, with attractive covers, and of such size that they can easily be carried in the pocket.

The first is headed "Automanual Development" and deals with engineering problems, descriptive terms and maintenance expense and shows the advantages of a system combining automatic and manual service. This system claims to save from 40 per cent of "A" operators to 100 per cent of "B" operators. Increased efficiency, low cost and maintenance expense

places this class of service beyond the experimental stage, and seems to give it a lasting success.

The second bulletin is headed "The Automanual Operator" and in concise language tells the reader how his connections are put up, and the accuracy and speed this service offers. The operator's duties are simple and successive; they do not overlap. She has no cords and plugs to contend with, no reaching for multiple jacks or busy test, no ringing, supervision or disconnect.

At the close of this bulletin it is stated that the automanual represents the most advanced thought and development in the art of telephony.

The third bulletin is headed "The Automanual Subscriber," and states that automanual service gives the subscriber absolutely private conversation; it is impossible for the operator to disconnect or listen in, leaving the control of the circuit entirely with the two subscribers.

Ten-party selective service can be supplied by the use of a ground at each of the ten telephones. All circuits are balanced and free from cross talk or inductive effects, and conform to standard engineering practice.

Great credit is due Mr. J. F. Engle for the general arrangement of the above-mentioned bulletins; and the company will be pleased to mail, together with any other information relative to the automanual service, to all interested parties.

New Harvard Catalogue

The Harvard Electric Company, Chicago and New York, has just issued a new catalogue known as No. 20, which is descriptive of a part of the many electrical necessities made by the Harvard company.

In this bulletin, which relates chiefly to Harvard patent galvanized channel steel brackets, sectional switch boxes, conduit boxes, fuse wire, fuse strip, open fuse links, Harvard bevel edge self-welding wire joints, fuse blocks and telephone fuses, test connectors, cable hangers, etc., etc., there is given a detailed description of the various Harvard specialties, dimensions, etc. Harvard specialties are used by the Bell and larger independent telephone companies, electric light companies and electrical contractors. A copy of the catalogue will be mailed to any one interested upon request to the company.

The Standard Earth Auger

The Standard Earth Auger Company is living up to its trade words: "On Earth—Best—In Earth." Its auger is made in three sizes, Nos. 5, 8 and 10, boring holes 3½ feet deep and capable of boring holes 6 feet deep when equipped with a patent telescope stem. Auger No. 5 equipped with an adjustable feature bores holes 5 to 8 inches in diameter. No. 8 bores holes 8 to 14 inches in diameter. No. 10 bores holes 8 inches to 16 inches in diameter.

The Standard earth auger is so constructed that the cutting blades work at a greater diameter than the bearing surfaces, thereby eliminating the time wasting delay caused by binding in the hole.

The double V point cutting blades are of such strength that they will enter hard earth and yet of such close working construction that they will hold fine dry sand. They bear the unqualified endorsement of telephone, telegraph, electric light and railway companies as well as filling the requirements of the farmer, stockman, poultryman and others of this class.

Book Review

Technical Press Index is a compilation of items which have appeared in the Technical Press Index section of the Engineering Digest during the eighteen months from January, 1908, to June, 1909, inclusive, which have been rearranged, reclassified and cross-indexed. It gives a key to more than 11,000 articles of permanent value, which are intended to include every important paper and article published in the regular engineering periodicals in the United States, Canada and Europe, and in the proceedings of the various engineering and technical societies during that period. The arrangement is such as to render the search for any article on any particular subject easy. The whole classification is separated into a number of broad divisions, and under each technical division are numerous subdivisions, which, with the cross-indexing, renders the volume valuable to anyone interested in technical literature. Cloth, 374 pages. Price, $3.00.

Gets Automobile Idea from Telephone

The purchase of the John R. Keim Mills, Buffalo, N. Y., by the Ford Motor Company, was the result of a new telephone installed on the desk of Henry Ford about four years ago.

On the old telephone the metal upright and the base were separate. On this new telephone the entire casing was one piece drawn from a single sheet of steel. The new casing looked like a miniature rear axle housing.

If machinery could manufacture small one-piece telephone casings, machinery could be made to make one-piece rear axle housings. So Mr. Ford hunted up the manufacturer of the telephone casings. It was the John R. Keim Mills, of Buffalo. Mr. Ford handed them the telephone casing, with the abrupt remark, "I want two hundred thousand casings just like that, except larger."

It had never been attempted. The telephone casing was itself a decided advance in construction over anything previously manufactured, but the Keim Mills people were willing to try, if Mr. Ford would help them.

They worked it out together, and when the machinery was perfected the John R. Keim Mills, the only concern that could make one-piece axle housings, received the order from the Ford Motor Company, the only concern using one-piece housings.

On February 2 Mr. Ford went out to Buffalo and bought a controlling interest in these mills, now prosperous and strong. The sale of the controlling interests in these is interesting as well as important for various other reasons. A duplicate of this plant would require eighteen months to build and half a million dollars to accomplish.

The telephone on Mr. Ford's desk that gave him the idea was made by the Dean Electric Company.

Johann and Johann report that they have finished cabling Toledo and Greenup, Illinois, and have closed a contract with the Douglas County Telephone Company of Tuscola for the finishing of the cabling work at Homer, Illinois, which includes putting up 2,000 feet more of cable.

Brevities of the Business

PERSONAL NOTES.

At a meeting of the board of directors of the New York Telephone Company Union N. Bethell was elected president to succeed Theodore N. Vail, and he becomes chairman of the board of directors. The following changes were also made in the board of directors: Messrs. W. D. Sargent, Brooklyn, N. Y., ex-Governor Griggs, Paterson, N. J., James H. Manning, Albany, N. Y., John F. Maynard, Utica, N. Y., William Nottingham, Syracuse, N. Y., Benjamin E. Chase, Rochester, N. Y., and Henry M. Watson, Buffalo, N. Y., were elected directors in place of Messrs. Davis, Kingsley, Gould, Clowry, Willever, Vanvery and Brooks, resigned. The retiring directors represent the Western Union interests on the board. In addition to being president of the New York Telephone Company, Mr. Bethell is now president of the Bell Telephone Company of Pennsylvania, the Central District & Printing Telegraph Company, The Chesapeake & Potomac Telephone Company, The Delaware & Atlantic Telegraph & Telephone Company, and the Diamond State Telephone Company, covering a territory of about 124,000 square miles. The telephone plant in this territory represents an investment of about $175,000,000, and the companies supply telephone service to more than 1,150,000 telephones, and furnish employment to more than 31,000 employes. Mr. Bethell is also vice-president of the American Telephone & Telegraph Company. Mr. Bethell has been in the telephone field since 1888, although he is a comparatively young man, being only 50 years old. He was born in Indiana, and graduated from Hanover College in 1879, and later went to Washington where he was employed in the pension bureau. During his stay in Washington he attended the Columbia Law School from which he graduated. Shortly after he was admitted to the bar. He went to New York and becoming interested in the telephone business, which at that time was in its infancy, entered actively into telephone work. His rise was rapid, and shortly after becoming identified with the New York & New Jersey Telephone Company, he was made secretary and treasurer of that company. In 1893, due to his conspicuous ability, he was made general manager of the New York Telephone Company, and shortly after was made vice-president. With his election to the presidency of the New York Telephone Company, Mr. Bethell becomes the head of the largest group of operating telephone companies in the Bell system.

John Watts, Rock Island, Ill., has assumed the management of the Central Union Telephone Company's exchange, East Moline, Ill.

J. E. Farnsworth, formerly vice-president and general manager of the Southwestern Telephone & Telegraph Company, Dallas, Tex., was recently elected president of the company.

Fred O'Brien, Lansing, Mich., has been appointed manager of the Citizens' Telephone Company, Marshall, Mich., succeeding H. H. Taylor, who assumes a similar position in Battle Creek.

L. M. Loving, formerly division traffic superintendent of the Southwestern Telephone & Telegraph Company, Dallas, Tex., has been elected secretary of that company.

F. E. Bentley has been appointed manager of the Citizens' Telephone Company, Montevideo, Minn.

Announcement has recently been made that Mr. F. X. Cleary has been appointed advertising manager of the Western Electric Company. Mr. Cleary has been with the Western Electric Company for about twenty years and has held important positions connected with the execution of sales campaigns for the company. Under Mr. Cleary's direction the advertising of the Western Electric Company, which has been so successful in the past, will be conducted and extended along the same general lines.

C. L. Cummings, Carrollton, Mo., who has been connected with the Bell company for some time, has been appointed superintendent of the Moberly Telephone Company, Moberly, Mo.

H. C. Slemin, sales and advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has been elected a member of the Technical Publicity Association, an organization which includes in its membership the advertising representatives of many of the leading concerns of the country.

J. T. Quinlan, formerly district manager of the Green Bay District of the Wisconsin Telephone Company has resigned his position to take a position with a Bell company of the Pacific coast.

G. E. A. Moeller, manager of the Rocky Mountain Bell Telephone Company, Buffalo, Wyoming, recently died very suddenly at his home in that city, of heart disease.

C. R. Langley has been appointed manager of the Coos Bay Home Telephone Company which operates a number of exchanges and toll lines throughout Coos and Curry counties, Oregon.

C. F. Boolschweiler has resigned his position with the Pacific Telephone & Telegraph Company of Los Angeles, Cal., to accept the position of general superintendent of plant of the British Columbia Telephone Company of Vancouver, B. C.

Harry Miles, formerly manager of the Benton Independent Telephone Company, Prosser, Washington, has resigned his position with that company to accept one with the British Columbia Telephone Company, Prince Rupert, B. C., where he will have charge of the construction of the plant, also the management of the company.

C. E. Stratton, who for ten years has held the managership of the Colorado Telephone Company for southern Colorado and northern New Mexico, with headquarters at Trinidad, Colo., has been appointed district manager for the Colorado Springs district with headquarters in that city.

Charles Weaver has resigned his position as manager of the telephone exchange at Mount Morris, Ill., and will go to Wyoming where he will install an exchange at Sheridan and will assume the management of the same.

M. E. Hall, Fargo, N. D., has been appointed manager of the North Dakota Independent Telephone Company's exchange at Dickinson, N. D.

William Brooks will have the management of the Colusa County Telephone Company's system, with headquarters at Colusa, Cal. The system covers the entire county.

Nectaire Rousseau, who superintended the installation of the first telephone system in Chicago and was prominently connected with the early development of the telephone and telegraph service in the west, recently died of heart failure at his residence, 1280 Oregon avenue, Chicago, Ill., at the age of 72. He entered the service of the American District Telephone & Telegraph Company in 1856 and was later identified with the Western Union Telegraph Company as superintendent of the western territory when it was first organized. For a number of years prior to 1894, when he retired, he was in the service of the Chicago Telephone Company.

Prof. Amos E. Dolbear, Tuft's College, Boston, died February 23, 1910. Scientific records credit Professor Dolbear with the following inventions: Writing telegraph, discovered convertibility of sound into electricity; magneto telephone, static telephone, telegraphing without wires, air space telegraph cable, spring balance ammeter, photographing with electric waves. He was awarded a bronze medal for acoustic apparatus at the Centennial Exposition, 1876, and a gold medal in London, 1882, for the static telephone.

CONVENTIONS.

The annual convention of the Kansas Independent Telephone Association will be held at Topeka, April 26, 27 and 28. The program will be planned along new lines and will be intended primarily for the benefit of the small exchange operator.

The Indiana Independent Telephone Association will meet in annual convention at South Bend, May 11 and 12.

IN THE MARKET.

Whitesburg, Ky.—The Whitesburg Telephone Company is negotiating with Samuel Collins and others for the sale of their lines and franchises in Letcher county. The company has been making some much-needed improvements during the past few months. For further information, address J. P. Lewis, manager Whitesburg Telephone Company, Whitesburg, Ky.—W.

Pine Top, Ky.—The Carrs, Fork & Hindman Telephone Company makes the announcement that it has increased its capital stock from $2,500 to $3,000 and will buy and install a switchboard at Pine Top and Hindman, giving long distance connec-

tion with Prestonburg, Ky., and Pikeville, Ky. Some new lines will also be constructed during the spring and summer. Construction material will be needed. Address S. R. Blair, manager Carrs, Fork & Hindman Telephone Company, Pine Top, Ky.—W.

Dwarf, Ky.—J. P. Smith and others will shortly build and maintain a local, independent telephone line here, besides building a connection with the Perry County Telephone Company's lines at Hazard, Ky., fifteen miles. A switchboard is wanted, as well as construction material. Address J. P. Smith, manager, Dwarf, Ky.—W.

Pound, Va.—The Wise County Telephone Company has just been organized here by C. F. Miller and others with a capital stock of $3,000, for the purpose of building and maintaining an exchange at Pound. They will also construct lines to Flat Gap and Dewey, fifteen miles, and to Vilas, Ky., eighteen miles. All material will be needed. Address Wise County Telephone Company, Pound, Va.—W.

Democrat, Ky.—The Upper Rockhouse & Beaver Creek Telephone Company announces that it has secured franchises for a local independent telephone line from Democrat via Bath to Pine Top, Ky., and will begin construction at once. It will make other improvements on its line. Address T. A. Cook, manager Upper Rockhouse & Beaver Creek Telephone Company, Democrat, Ky.—W.

Hindman, Ky.—Hindman Telephone Company is in the market for a good-sized switchboard and has secured rights of way for a local independent line from Hindman via Vest and Sassafrac to Buckhorn, Ky., twenty miles. Address Hindman Telephone Company, Hindman, Ky.—W.

Sergent, Ky.—Sergent-Ola Telephone Company will shortly construct a local independent telephone line from Sergent via Lester to Camp Branch, Ky. Material will be needed. Address Sergent-Ola Telephone Company, Sergent, Ky.—W.

NEW TELEPHONE COMPANIES.

Pocahontas, Ark.—Articles of incorporation have been filed with the secretary of state for the Farmers' Telephone Company by H. M. Crockett, Jos. Ham, John R. Holt, J. A. Prevett and others; capital stock, $12,000.

Wilmington, Del.—The Wilmington Automatic Telephone Company has been incorporated by Henry F. Scott, Wm. T. Spring, Frank J. Hensel and John M. Lindsay, all of Wilmington, with a capital stock of $1,000,000.

Wilmington, Del.—The Ecuador Long Distance Telephone Company is the name of a new organization incorporated with a capital stock of $1,000,000 by Harry W. Davis, F. H. Shive and S. S. Roberson of Wilmington.

Easton, Ill.—The Easton Switchboard Company has been incorporated by William Walters, Thompson DeFue, J. S. McKinley, and Edward Furrer.

Mapleton, Ill.—The Mapleton Telephone Company is the name of a new organization which has just been incorporated by Alva Scott, Grant Powell, and Albert D. Maple.

Birmingham, Ill.—The Birmingham Mutual Telephone Company has been incorporated by Albert S. Glass, John Sharon and Villroy Cox; capital stock, $2,500.

Kinderhook, Ill.—Articles of incorporation have been filed for the Kinderhook Telephone Company by Wm. Knodel, James P. Blake, and W. C. Reinhart. The capitalization of the company is $2,500.

Rickardsville, Iowa.—Articles of incorporation have been filed with the county recorder by the Rose Valley Telephone Company. The capital stock is $10,000 and the officers are as follows: President, F. W. Farni; vice-president, Roy Boemecke; secretary, B. E. Boyes; treasurer, Frank Bahl.

Wren Hill, Iowa.—The Wren Hill Telephone Company has been incorporated by John Nonnon, S. D. Grey, J. S. Carson, M. C. Foster, Frank Fox and John Brinegar.

Peterson, Iowa.—Fred Plagman, C. W. Plagman, John Keadt and E. J. Mever have incorporated the Brooke Telephone Company with a capital stock of $1,000.

Sioux City, Iowa.—The Woodbury County Telephone Company has been incorporated with headquarters in this city. The capital stock is $100,000 and A. J. Westfall is president of the company.

Wingo, Ky.—The Star Telephone Company has been incorporated by L. A. Wesson, J. M. Walker and J. S. Bryn.

Leeds, Me.—The Leeds Telephone Company was recently organized with the following officers: President, A. L. Thomas; treasurer, F. H. Herrick, of this place. The capitalization is $10,000.

Hokah, Minn.—Articles of incorporation have been filed for the People's Telephone Exchange Company; capital stock, $10,000. The officers of the company are as follows: President, John Schild, Mound Prairie; secretary, George Flannery, Brownsville; treasurer, G. R. Reay, Hokah.

East Grand Forks, Minn.—The Red River Telephone Company has been organized. W. H. Portens is secretary-treasurer of the company.

Stockton Springs, Me.—The Stockton Springs Telephone Company has been incorporated for the purpose of installing and operating a telephone system in this place and also at Sandy Point.

Ada, Mich.—The merchants and farmers of Ada and vicinity have organized the Mutual Telephone Company. The officers of the new concern are: President, Frank Canfield; vice-president, Charles Inman; secretary, R. F. Anthony.

Blooming Prairie, Minn.—The Farmers' and Merchants' Telephone Company has been incorporated by C. A. Backman, G. A. Peterson, Swen Swenson, D. E. Jones, O. G. Anderson and P. K. Dock.

Tintah, Minn.—The Tintah Telephone Company has been incorporated with a capital stock of $10,000. Geo. W. Mace is president; J. R. Davison, vice-president; N. F. Doleman, secretary, and J. P. Dahlquist, treasurer.

Stillwater, Minn.—The Midway-Stillwater Farmers' Telephone Company has been incorporated with a capital stock of $25,000 by N. C. Mosegaard, H. R. Anderson, and others.

Beth Eden, Miss.—The Gentry Telephone Company has been organized by J. A. Gentry, J. H. Croft and others, with a capital stock of $5,000 for the purpose of operating throughout Winston county.

Butte, Mont.—The Intermountain Construction Company has been incorporated with a capital stock of $100,000. The incorporators are T. S. Lane, and H. R. Brown, of Butte, and I. O. Evans, of Salt Lake City.

Litchfield, Neb.—The Farmers' Mutual Telephone Company has been incorporated by Wm. Garnett, F. M. Goff, W. J. Heapy and John Stewart; capital stock, $20,000.

Keystone, Neb.—Articles of incorporation have been filed for the Keystone Northern Telephone Company; capital stock, $1,400. The incorporators are O. F. Chesebro, C. E. Phillips, H. H. Garrett and James McArthur.

Kearney, Neb.—The Buffalo Telephone Company has been incorporated by George Bischel, H. G. Reiter and Peter Wink; capital stock, $10,000.

Trenton, N. J.—The International Telephone Supply Company has been incorporated in this city with an authorized capital of $1,000,000, fully paid in. The object is to manufacture and deal in telephone and telegraph supplies. The incorporators are John C. Burmeister of Chicago and William H. Agricola and Robert P. Maple of New York.

Englewood, N. J.—The Central Home Telephone & Telegraph Company has been incorporated by John Heck of Westwood, N. J., with a capital stock of $20,000.

Freeville, N. Y.—F. Skilling, F. E. Brown, E. T. Brown and A. A. Sager have organized the Freeville Telephone Company.

Addison, N. Y.—The Addison Telephone Company has been organized and the directors are as follows: V. A. Manley of this place and G. B. Stephens and H. F. Flint of Clifton Springs.

Angelica, N. Y.—Articles of incorporation have been filed for Enterprise Telephone Company. The incorporators are C. T. Ohlinger, L. B. Chaffee, H. F. White and others, and the capital stock is $4,000.

Boonville, N. Y.—The Lansingkill and Potato Hill Telephone Company has been organized to operate from this place. The capital stock is $2,000 and the directors are: Vosley Pixley, Oliver W. Fitch, Ray Carmichael, Robert Farley, William Penn Griffith, James M. Sorenson and J. W. Ridgely, all of Boonville.

Cleghorn, N. C.—The Cleghorn Southern Telephone Company has been organized by S. S. Settlemeyer, J. W. Braley, Matt Saner and Charles Specht.

Wilkesboro, N. C.—The Lewis Fork Telephone Company has been organized with A. P. Hall as president; C. R. Triptell, vice-president; H. W. Foster, secretary-treasurer.

Merry Hill, N. C.—The Bertie Telephone Company has been chartered with a capital stock of $10,000.

Goodrich, N. D.—The Goodrich Telephone and Electrical Company is the name of a new organization incorporated by C. E. McReynolds, E. M. Jassamann and John M. Jassamann. The capital stock is $10,000.

Larson, N. D.—The Farmers' Co-Operative Telephone Company has been incorporated here by H. C. Kleinschmidt, Gustav Bjorkman, A. R. Peterson and others. The capital is $30,000.

Turtle Lake, N. D.—Articles of incorporation have been

filed for the McLean County Farmers' Telephone Company by J. E. Heck, J. B. Sellon and J. E. McAdoo; capital stock, $25,000.

STILLWATER, N. D.—The Midway-Stillwater Farmers' Telephone Company has been incorporated. The capital stock of the company is $25,000 and the directors are E. C. Mosgaard and H. R. Anderson, Scranton; H. L. Dolge, Edward Feldhausen, August King and George Warnke, Stillwater; George Silvius, Buffalo Springs.

WAYNOKA, OKLA.—Articles of incorporation have been filed for the Waynoca Local and Long Distance Telephone Company with a capital stock of $10,000. The incorporators are L. B. Collins, N. J. Collins and others.

BERTRAND, OKLA.—Application has been made for a charter for the Cimarron Telephone Company, recently organized with the following officers: President, H. L. Huddleston; vice-president, J. E. Brandeberry; secretary, J. M. McDaniels; treasurer, J. W. Brooks.

YAMHILL, ORE.—The Yamhill Mutual Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are W. G. Moore, E. B. Flett and A. C. Goodrich.

BURNS, ORE.—The Union Telephone & Telegraph Company has been incorporated; capital stock, $5,000. The incorporators are J. H. Jordan, John Jenkins, C. H. Voegtle and J. F. Lawrence.

MADRAS, ORE.—The Deschutes & Harney Telephone Company has been organized. The company will install an exchange in this place and extend lines to the surrounding country.

CLEONA, PA.—Articles of incorporation have been filed for the Cleona, Bismarck and Fontana Rural Telephone and Telegraph Company with a capital stock of $5,000. Abraham B. Horst, Annville, Pa., is treasurer of the company; M. A. Meyer and H. B. Horst, Annville, and G. Holzapel, Cleona, directors.

GOLD, PA.—The Gold Telegraph and Telephone Company has been incorporated; capital stock, $5,000. H. M. White, Ulysses, Pa., is treasurer. The directors are F. H. Langdon, A. V. White and W. M. Grover of New Field and W. D. Smith of Genesee.

ORANGEVILLE, PA.—Application has been made for a charter for the Ebenezer Telephone Company of Center Township. G. M. Whitmire of this place is treasurer of the company.

GLEN ROCK, PA.—The Glen Rock Freedom Telephone and Telegraph Company has been incorporated at this place with a capital stock of $7,000. Paul J. Beck is treasurer of the company and Joseph Dise and A. S. Norrish, Glen Rock; W. H. Freed, Freedom, and E. H. Eterner, Codorus, directors.

TURBOT, PA.—A charter has been granted the Turbot Telephone Company. The capital stock is $5,000, with $500 paid in, and the incorporators are John A. Leinbach, Harry C. Wagner, and Calvin Hoy.

LIVERPOOL, PA.—Articles of incorporation have been filed with the secretary of the state for the Tri-County Telephone Company; capital stock, $10,000. The incorporators of the company are John D. Snyder, president; H. A. S. Shuler, treasurer; H. C. Elinger, A. M. Shuler and J. P. Aikens. It is the purpose of the company to construct and operate lines in Snyder, Perry and Juniata counties.

ORANGEBURG, S. C.—The Orangeburg and Bowman Telephone Company has been organized by W. H. Dukes and J. L. Dukes. An exchange will be installed at Bowman and connection established between Orangeburg and Bowman.

LEMMON, S. D.—The Perkins County Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Ole B. Quammon, C. C. Hoisington, E. D. Payne, C. D. Smith and L. W. Dousman, all of this place. It is the purpose of the company to construct and operate lines in the northwestern part of the state.

MCINTOSH, S. D.—The Corson County Telephone Company has been incorporated by E. J. Cook, J. E. Davis, and J. A. Archbault. The company is capitalized at $25,000.

DALLAS, S. D.—The Western Telephone Company has been incorporated; capital stock, $25,000. The incorporators are Ernest H. Jackson, Burl H. Martin, Frank H. Jackson, Graydon B. Jackson and A. F. West.

CLARK, S. D.—The Day Township Telephone Company has been granted a charter. The capital stock is $5,000 and the incorporators are as follows: J. H. Beatty, F. E. Cochrane and L. B. Cradit.

CAVOUR, S. D.—The Cavour Telephone Exchange has just been incorporated with a capital stock of $2,000. The incorporators are James H. Alney, H. C. Teets, B. H. Douglas, G. M. Martin and A. M. Giles.

BOWDLE, S. D.—The Spring Lake Farmers' Telephone Company has been incorporated with a capital stock of $1,000 and the officers are as follows: President, Thomas Murray, vice-president, August Erbe; treasurer, Joseph Stangl, Java; secretary, H. J. Woisnak, Java.

HUDSON, S. D.—The Riverside Rural Telephone Company has been incorporated.

CLARK, S. D.—Articles of incorporation have been filed for the Mount Pleasant Telephone Company.

STICKNEY, S. D.—The Pleasant Lake and Dudley Telephone Company has been granted a charter.

RETREAT, VA.—The Mutual Telephone Company of Franklin and Roanoke counties has been incorporated; capital stock, $5,000 maximum; $1,000 minimum. The officers are: President, L. A. Bowman, Callaway; vice-president, O. B. Jamieson, Boones Mill; secretary, T. F. Montgomery, Wirtz.

SOUTH SIDE, WASH.—The Southside Telephone Company has been incorporated by W. A. Kiser, L. J. Coonan and W. R. Ball, with a capital stock of $50,000. Mail should be addressed to Wenatchee.

MOSES LAKE, WASH.—Articles of incorporation have been filed for the Hicksville-Wheeler Telephone Company by C. G. Henderson, Geo. C. Rinehart, W. H. Thompson, E. S. Durham and W. E. Kapp. The capital stock is $2,000.

CLEAR CREEK, W. VA.—The Clear Fork Telephone Company is the name of a new organization recently incorporated with a capital stock of $5,000 by J. W. McGinnis, G. H. Williams, K. M. Jarrell and E. G. Lilly of Clear Creek, and Elijah Stover, Sanford Williams, Daniel F. Workman and others, of Artle, W. Va.

HILLSBORO, WIS.—The Hillsboro Telephone Company has been organized by a number of farmers in Hillsboro township, and connection will be made with the local exchange in this place.

NEW RICHMOND, WIS.—The St. Croix Telephone Company has been incorporated by John J. Padden, Andred Tobin and L. A. Baker; capital stock, $25,000.

VAN DYNE, WIS.—H. J. Haubrick, E. G. Stillemacher, William Tank and John Kind have organized the Van Dyne Telephone Company with a capitalization of $5,100.

LOYAL, WIS.—The Clark County Telephone Company has been incorporated with a capital stock of $4,000. The incorporators are A. W. Hales, M. F. Doyle and C. H. Brown.

GREENVILLE, WIS.—The South Greenville Farmers' Telephone Company is the name of a new organization incorporated in this place with a capitalization of $7,200. The incorporators are Louis Pingle, J. H. Schneider and Albert Mass.

NEWCASTLE, WYO.—The Western County Telephone Company has been granted a charter by the secretary of state. The capitalization is $5,000 and the incorporators are Charles Carlson, C. F. Cummings, Walter Roadifer, L. R. Keyes, J. M. Cornelison, E. R. Maris and A. M. Nichols.

RATES.

ASHTABULA, OHIO.—The Ashtabula Telephone Company has asked for amendments to its franchise permitting an increase of seventy-five cents a month on business telephones and twenty-five cents on residence telephones. The company has had to rebuild its exchange twice since 1897, bringing the depreciation charge up to twenty per cent. It also suffered heavy damage during the sleet storm last February.

AKRON, OHIO.—The Akron People's Telephone Company has announced an increase of rates from $30 to $42 per year for private line telephones. The maximum rate heretofore has been $36 and the minimum rate $24 a year. The new rate will go into effect as the old contracts expire.

CLEVELAND, OHIO.—Independent telephone interests in Ohio, who insist they have been getting the worst of the long distance rate revision recently put into effect, have won out in their contention for a readjustment of schedules. At a meeting of the board of the United States Telephone Company held recently, directors adopted a resolution, placing the readjustment of rates in the hands of President Frank A. Davis, and assurances were given by the company that an equitable adjustment of long distance rates now being made could be perfected as rapidly as possible.

COLUMBUS, IND.—As a result of a conference of telephone men held at Flatrock recently, there will be an increase of twenty-five cents in rates, to be effective about the first of May. The increase will affect the following exchanges: Flatrock, Hope, Lewis Creek, Marietta, Cave Mills and Edinburg. The Citizens' Telephone Company, of this city, will make no increase, as its rates are now as high as its franchise permits.

FINANCIAL ITEMS.

Ansonia, Conn.—An amendment has been filed with the secretary of state by the Connecticut Telephone and Electric Company increasing its capital stock from $45,000 to $250,000.

Vienna, Ill.—The Vienna Mutual Telephone Company has increased its capital stock from $6,000 to $10,000.

Robinson, Ill.—The capital stock of the Southeastern Illinois Long Distance Telephone Company has been increased from $50,000 to $100,000.

Maroa, Ill.—The Maroa Mutual Telephone Company has increased its capital stock from $10,000 to $20,000.

Monroe, La.—The Home Telephone Company has doubled its capital stock increasing it from $25,000 to $50,000. Enough of the new stock has been subscribed for to pay off the debts and put the company on a good substantial paying basis.

Grand Rapids, Mich.—The State Railroad Commission has authorized the Michigan Independent Telephone Traffic Association to issue stock to the amount of $10,000.

Paducah, Ky.—The Heath Telephone Company has filed an amendment to its articles of incorporation increasing its capital stock from $1,000 to $2,000.

Pleasantown, Neb.—The Buffalo County Telephone Company will increase its capital stock from $5,000 to $10,000.

Elizabeth, N. J.—The Hudson and Middlesex Telephone and Telegraph Company has increased its capital stock from $250,000 to $1,000,000.

Wooster, Ohio.—The capital stock of the Wayne County Telephone Company has been increased from $100,000 to $125,000.

Stuart, Okla.—The A. C. McAnally and Brothers Telephone Company's stock has been increased from $500 to $2,500.

Oklahoma City, Okla.—One million dollars in added stock, the proceeds to be spent in increased service in Oklahoma, has been sold by the Pioneer Telephone Company, and $1,426,000 more will be sold within the next year. Of this sale within the next year, in Oklahoma City alone, one quarter of a million will be spent in added equipment. The capital of the Pioneer company, up to this last issue of stock, was $2,243,000. The expenditure of the company in this city alone during 1909 was $200,000. During the present year it will be $250,000.

Red Hook, N. Y.—The Red Hook Telephone Company has increased its capital stock from $5,000 to $50,000.

Oconto, Wis.—At a meeting of the stockholders of the Farmers' Telephone Company it was decided to increase the stock of the company $20,000 for the purpose of making extensions, work to begin in the spring.

Plymouth, Wis.—The Plymouth Telephone Company has filed an amendment increasing its capital stock from $1,100 to $6,000.

Hazard, Ky.—The Merry County Telephone Company has increased its capital stock from $2,000 to $4,000 and will make some extensions.

Eau Claire, Wis.—The Eau Claire Telephone Company will increase its capital stock from $5,000 to $10,000 for the purpose of making extensions and improvements and bettering its service.

Pontiac, Ill.—The Automatic Home Telephone has increased its capital stock to $310,000, for the purpose of improving its system.

Hyden, Ky.—The Hyden Telephone Company has increased its capital stock from $3,000 to $5,000. The company will make extensions and improvements.

Denton, Md.—The Farmers and Merchants' Telephone Company at a recent meeting voted to increase its capital stock from $25,000 to $50,000.

South Bend, Ind.—The Long Distance Telephone Manufacturing Company has given notice of reduction of capital stock from $100,000 to $50,000.

Beaver Crossing, Neb.—The Seward County Telephone Company has been authorized to issue $3,000 in bonds for the purpose of raising an outstanding note.

Clinton, N. C.—The capital stock of the Garland-Clinton Telephone Company has been increased from $5,000 to $25,000, and the name of the company has been changed to the Consolidated Telephone Company.

Wilmington, Ohio.—The Clinton Telephone Company has increased its capital stock from $125,000 to $200,000.

New Bremen, Ohio.—The capital stock of the New Bremen Telephone Company has been increased from $10,000 to $20,000.

Woodville, Ohio.—The LeMoyne Telephone Company will vote on the question of increasing its capital stock from $10,000 to $25,000.

Landis Store, Pa.—The capital stock of the Mountain Telephone Company has been increased from $5,000 to $15,000.

Lansford, Pa.—The stockholders of the Carbon Telephone Company recently voted to increase the capital stock from $2,000 to $6,000.

Stouchburg, Pa.—The Womelsdorf and Rehrersburg Telephone Company recently voted to increase its capital stock to $5,000.

Jonesville, Va.—The Lee County Telephone Company, recently organized, has increased its capital stock from $2,000 to $4,000.

Hickman, Tenn.—The Hickman Telephone Company had filed an amendment increasing its capital stock $500.

Eau Claire, Wis.—The Eau Claire County Telephone Company has increased its capital stock to $10,000.

Appleton, Wis.—The Appleton Creek Farmers' Telephone Company has amended its charter, increasing its capital stock to $10,000.

Mayville, Wis.—The Mayville Telephone Company has increased its capital stock from $24,000 to $60,000.

Oconto, Wis.—The capital stock of the Farmers' Telephone Company has been increased to $20,000 for the purpose of constructing additional lines.

Chicago, Ill.—An increase in the capital stock of the American Telephone and Telegraph Company from $300,000,000 to $500,000,000 will be voted upon at a special meeting of the stockholders to be held following the annual meeting.

Bellefontaine, Ohio.—The stock of the United Telephone Company has been increased from $300,000 to $400,000, the same to be used in extensions of the systems and in making improvements to the present system and local plant. W. W. Fisher is president of the company.

Topenish, Wash.—The Yakima Valley Telephone Company has increased its capital stock.

Lincoln, Neb.—The State Railway Commission has permitted the Albion Telephone Company to increase its rates, the new rates to become effective April 1.

FRANCHISES ASKED AND GRANTED.

Mayking, Ky.—The Mayking Telephone Company is seeking a franchise for the construction of local telephone lines.

Salisbury, N. C.—The County Commissioners have granted franchises to two new rural telephone companies to construct and operate telephones in the county.

Rosalie, Wash.—J. H. Van Dyke, David Cross and M. A. Phelps have applied for a twenty-five-year franchise to install and operate a telephone system in this city.

Minonk, Ill.—An indeterminate franchise, with certain conditions, was recently granted the S. C. Kipp Telephone Company by the city council. An entire new system will be installed and in the business district the wires will be placed under ground. A concrete fireproof building will be erected for the exchange and the total expenditure is estimated at $20,000.

Corinth, Miss.—The Home Telephone Company which has just completed the installation of its system in this city, has been granted a franchise in Tupelo. The work of construction will begin in the near future and will include much underground work. The company will also construct a copper circuit from Jackson, Tenn, to Meridian, Miss.

Ely, Nev.—The White Pine County Telephone Company has applied for a fifty-year franchise to replace the one given the company in 1906.

Minonk, Ill.—The S. C. Kipp Telephone Company has been granted an indeterminate franchise by the city council. The company proposes to erect a new telephone building at a cost of $20,000.

Guanajuato, Mexico.—A syndicate composed of George W. Bryant, Jose Bustamente and Nemecio Ponce, all of Guanajuato, has been granted a concession from the government of the state for the construction of an extensive system of telephone lines in this state and the establishment of local exchanges in this city and other towns.

Etna Mills, Cal.—The Independent Telephone Company, operating between this place and Fort Jones, has applied for a franchise to enter the town.

Ogden, Utah.—Officers of the Davis County Independent Telephone Company recently appeared before the county commissioners and formally accepted the franchise granted the company to operate in Weber county. Franchises in Cache county, Box Elder county and Salt Lake county are now being sought.